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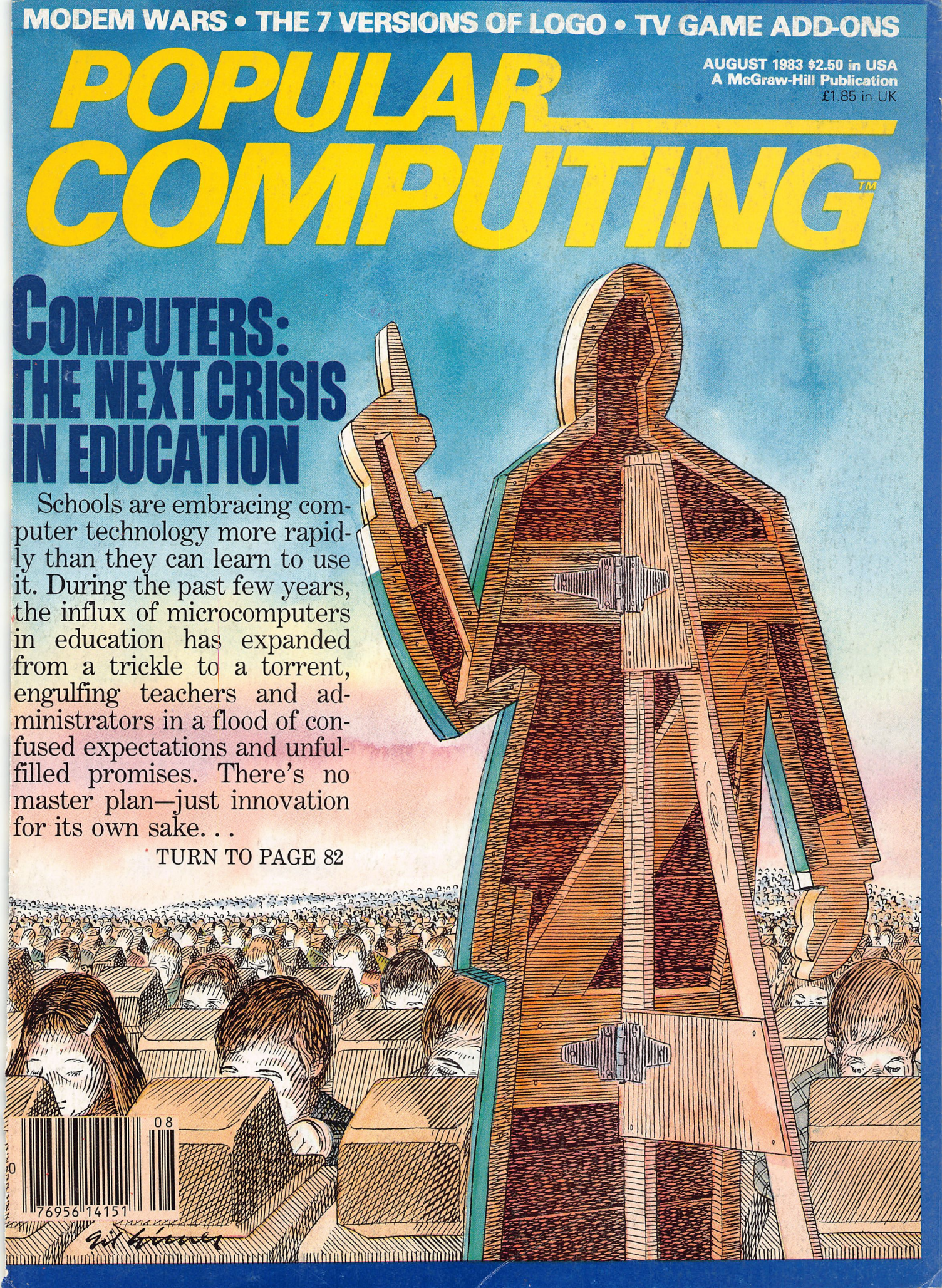

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Vol. 2, No. 10 August 1983

SPECIAL REPORT: COMPUTERS IN EDUCATION

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We're on the threshold of a new age in learning. The microcomputer is moving education in exciting new directions, yet at a pace so rapid no one is sure who's in charge. Our special report examines what's going on in the schools.

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by Dan Watt

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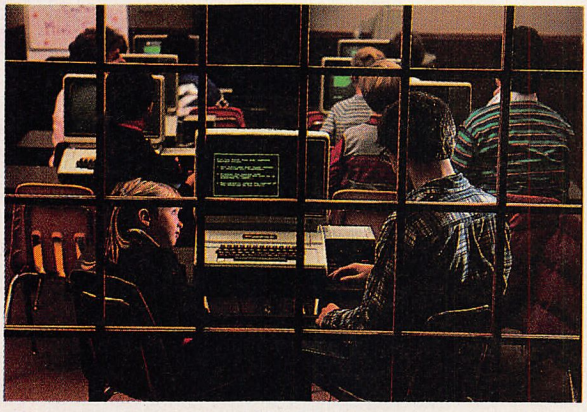

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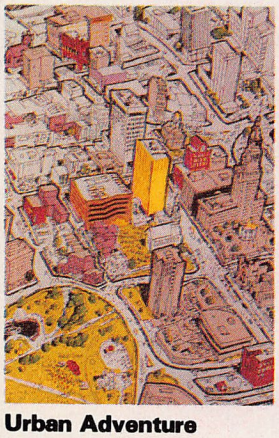

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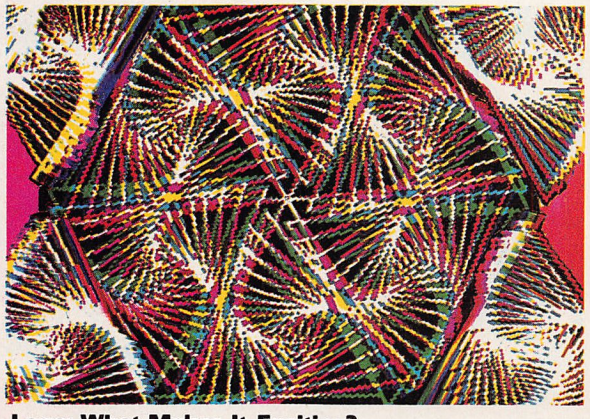

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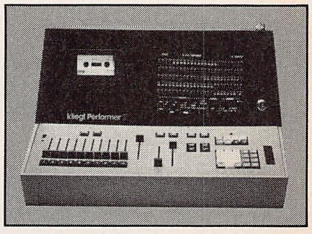

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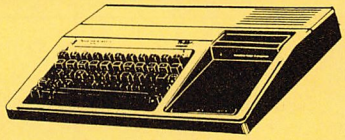

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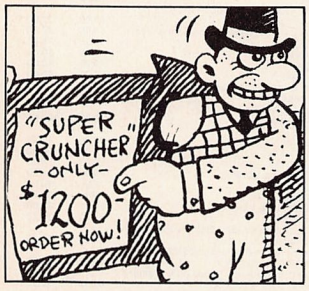

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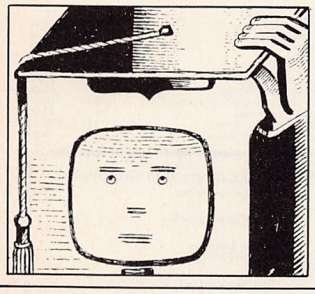

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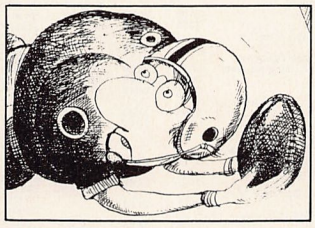

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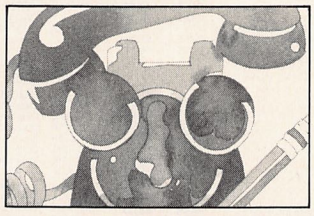

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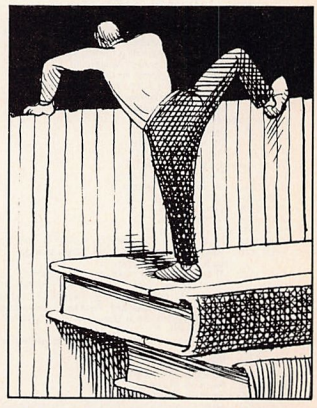

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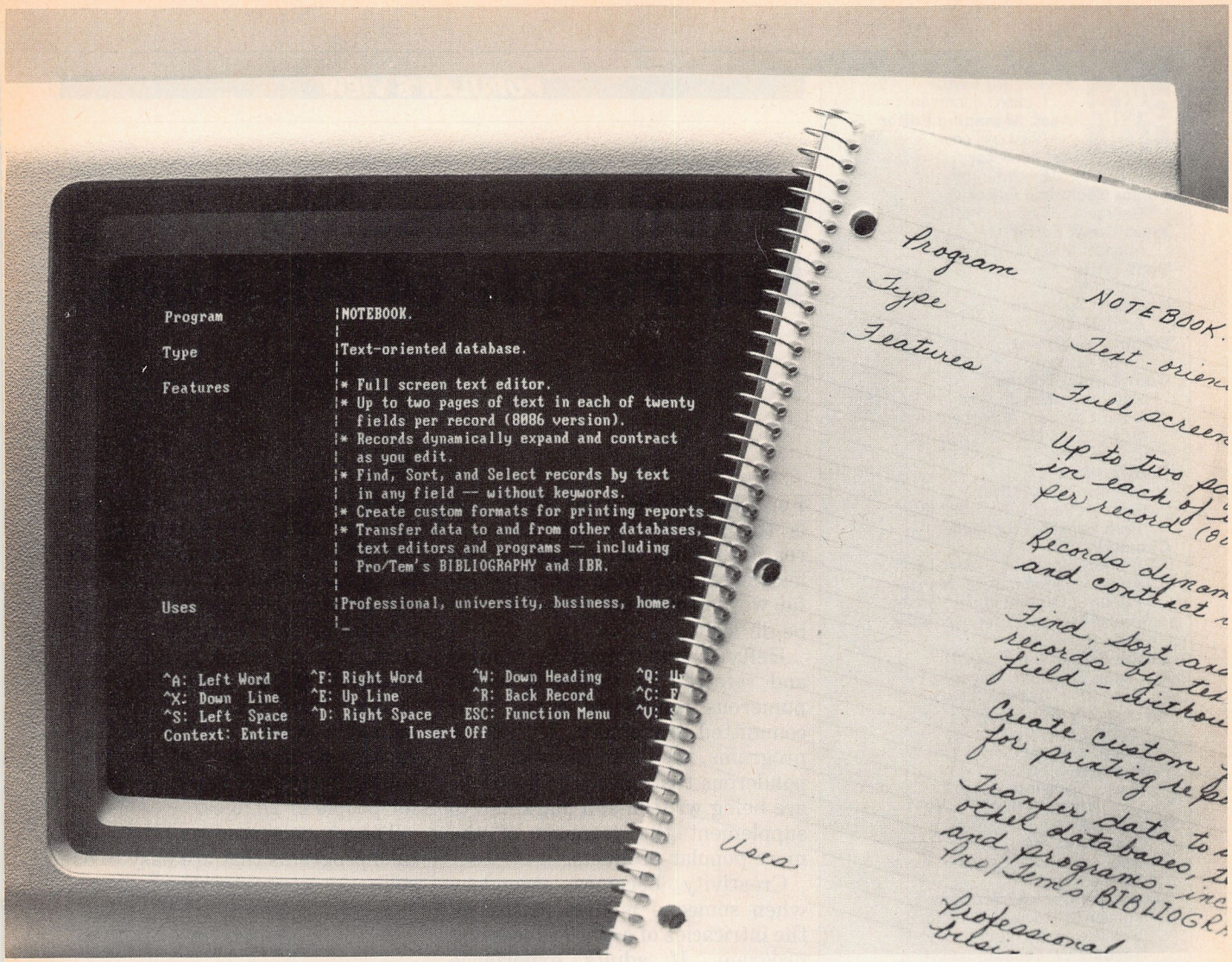

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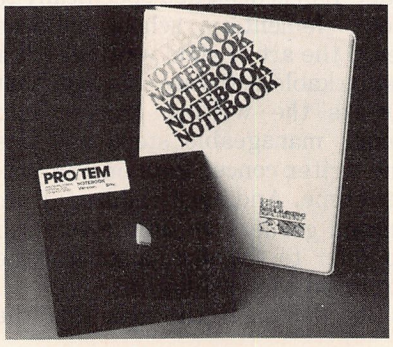

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Word Processing For People of All Ages

For many people word processing is the primary, if not the only, reason to buy a computer. But learning to use some of the powerful word-processing programs can be difficult.

Hefty manuals must be studied and referred to time and again; numerous commands have to be committed to memory. With some programs, the documentation is so ponderous that special paperbacks are being written and marketed to supplement the manuals of the more popular products.

Creativity becomes secondary when someone is first mastering the intricacies of a word-processing program. If adults experience frustration, think of how young children must feel when they first try to use a word-processing program.

Feature-ladened programs tend to complicate rather than simplify writing. This sophistication versus ease-of-use trade-off also holds true for database-management software, accounting packages, spreadsheets, and other types of programs.

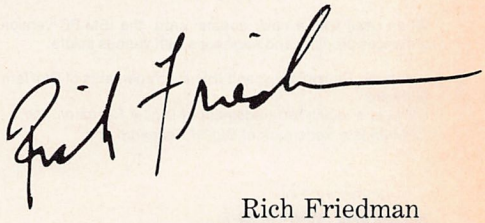
The Bank Street Writer word-processing program (see review, page 190) is designed specifically to help elementary school children learn the art of good writing. It's a remarkable software package that breaks the writing process into small, manageable steps and lets the writer concentrate on one task at a time. And most children (from second graders on up) never need to refer to the manual to use the program successfully.

But don't get the idea that the Bank Street Writer is a watered-down program for kids only. It's not. Powerful features include universal search and replace, block moves, automatic centering and indentation, inverse highlighting of text, word wrap, and more. Because of its straightforward design, Bank Street Writer has gained a wide following and has rapidly become one of the best-selling word-processing programs for people of all ages.

There's a simple moral to this tale: programs that are easy to use sell.

• • •

A bumper sticker that's around these days reads: "If you think education is expensive, try ignorance." One of the sad truths today is that it's easier for a school district to get approval to purchase a truckload of new computers than to use that money to retrain good teachers. In our special report on computer education we address this issue and the larger question of whether teachers and administrators have lost control trying to keep pace with the exploding information revolution. Our nation has a lot riding on how we answer that question.



Rich Friedman
Managing Editor

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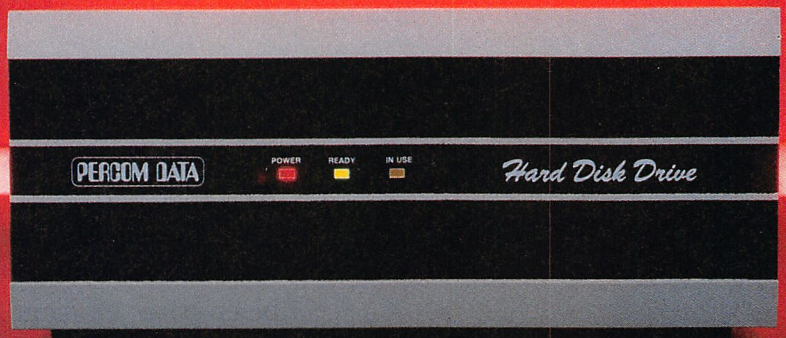

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The IBM Personal Computer

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And by adding an expansion unit with a *second* 10-megabyte fixed disk drive, you get even more high-volume capacity from the system. XT can run most of the same software and accept most of the same IBM hardware as the computer on the left. And its price/performance is nothing less than remarkable.

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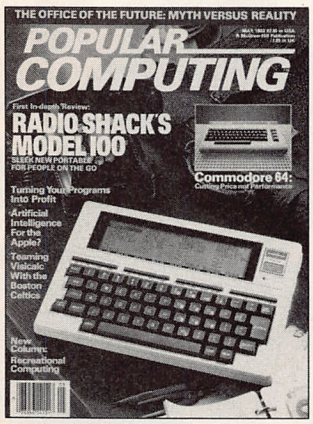

Engineers and Society
Dear Editor:

Having been involved in the engineering profession for the past 14 years, I can really identify with those who need to "keep up" with technological advances ("Lifelong Education," May 1983, page 62). I agree that U.S. industry should encourage and participate in the education of its employees and development of their technical expertise. But I also observe that this expertise or, in my opinion, narrow-mindedness has produced a group of social and political illiterates. If not nurtured in the proper social context, this technological sophistication can be usurped by industry and misdirected to its short-sighted ends.

Could it be the strong customs and social consciousness of the Japanese are what have combined with imported American know-how to create their great industrial power? If we are going to provide technical education for our engineers, why not also insist on a good humanities core along with it? For the managers, too!

If a competitive economy is our end goal, technology will not be used effectively—it will be used only to bolster quarterly reports.
Fred Matica
Mechanical Engineer
Mentor, OH

Flipping the Floppy
Dear Editor:

I am writing in response to statements made by Carlene Char in her article "A Complete Guide to The Disk" (May 1983, page 106). Our Company, Ultra Magnetics Technology Inc., manufactures high-quality flexible disks. It is our position that Ms. Char's article is misleading and incorrect, in certain cases, and we strongly advise against the adoption of some of her recommendations.

With regard to Ms. Char's discussion on "flipping the floppy," she says that it can be done, and as long as the disk isn't heavily used, it's O.K. She is right that it can be done, but during the testing process, manufacturers test both sides of the disk and when one side fails, that disk is sold as a single-sided product. In other words, many single-sided disks leave the factory with a known defect on the unused side.

Second, and I think more important, Ms. Char's recommended "test," that is, listening to the sound made by a disk during formatting, is not only technically incorrect but is very misleading. The American National Standards Institute (ANSI) requirement for surface roughness is 3 microinches (3 millionths of an inch) maximum. That's very smooth. The reason various brands of disks make different sounds is because of the liners used. There are a number of liners used in the industry and many different patterns of attachment. Some provide more wiping action than others. Since the primary purpose of the liner is to wipe the disk and trap debris, it is incorrect to assume that a disk that "sounds like coarse sandpaper" is abrasive and therefore not as good as a quiet disk. It is quite possible that the louder disk is the better disk.
Mark G. Kallin
Director of Business Planning
Ultra Magnetics Technology
Watsonville, CA

We agree with Mr. Kallin that using the reverse side of a single-sided floppy disk is a risky business and that it should never be used for sensitive data. And we thank him for enlightening us and our readers about the unreliability of the "loudness test" for disk quality.

Advertising Puffery Questioned
Dear Editor:

I enjoyed George Stewart's article on the TRS-80 Model 100 (May 1983, page 86) immensely. The day is not too far off when I'll be packing a computer in my briefcase, to supplement my Model II at home. But I wish computer companies (Tandy is not alone) were a little more candid a little more often about what their new products can and cannot do.

Mr. Stewart says in his article, "To avoid overselling TEXT [the Model 100's built-in software], Radio Shack carefully avoids calling it a word processor, using the term text preparation program instead."

You can imagine my surprise (and Mr. Stewart's, no doubt) at the ad that appeared in the same issue—word processing was one of the features claimed.
Kenneth G. Grant
Astoria, NY

Program Factory Update
Dear Editor:

Thanks for the great program on Encryption/Decryption in the April issue (page 214). A suggestion to you and your readers to improve the program: use line Input for program statement 180 and you can imbed the comma in the message you wish to process.
Charles F. Harrington
Associate Provost
Ohio University
Athens, OH

Not Starry-Eyed
Dear Editor:

One more article extolling the virtues of Wordstar (February 1983, page 116) and I cancel my subscription.
Robert A. Belden
San Diego, CA

In a year and a half we've had one article on Wordstar.

Videodiscs and the Army
Dear Editor:

I read your "Special Report on Videodiscs" (April 1983, page 78) with considerable interest. I was quite surprised to notice that there was no mention of the amount of usage which the videodisc is receiving within the Department of Defense and especially within the United States Army.

Popular Computing welcomes your feedback regarding articles that appear in this magazine as well as your comments about the personal computing field in general. Write to Letters, *Popular Computing*, POB 397, Hancock, NH 03449. (Due to the number of letters received, we cannot respond individually.)

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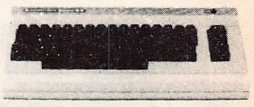

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LETTERS

The Army Communicative Technology Office (ACTO) at Fort Eustis, Virginia, has been using videodiscs in interactive training situations for a number of years and has produced videodiscs for other purposes since 1976.

For example, the U.S. Army Recruiting Command is currently in the process of fielding a microprocessor-controlled videodisc system called JOIN (joint optical information network) in all of its recruiting stations throughout the world. This system includes 33 videodisc sides containing information on all 265 recruitable military occupational specialties and information on all camps, posts, and stations within the army.

In another joint project between the ACTO and the Signal School at Fort Gordon, Georgia, a two-dimensional simulation of a satellite ground control station is in the process of being produced. This ground control station, which costs $14 million, is designed to be turned on and left on. This makes it virtually impossible to use the system itself for training purposes.

Having rejected the possibility of purchasing a three-dimensional training simulator, the ACTO and Fort Gordon produced an interactive training videodisc. The videodisc system includes an Apple II computer, a Pioneer PR-7820 videodisc player, a light pen, and other necessary interfacing equipment. Test results using this system showed that it was as effective as training on the actual equipment. And for a total cost of about $5000, this simulator is available all of the time.

Also, using only a Magnavox player, a section of an FM radio-repair course at Fort Bliss was recorded in a noninteractive mode and compared to the existing 35-mm slide/audio-tape method of presenting the course. Soldier reaction to the videodisc system again showed that training was equally effective with this system and that soldiers preferred it.

The ACTO is currently in the process of procuring an electronic information delivery system (EIDS) for the presentation of all army training. The EIDS will be a microprocessor-driven videodisc player system. By compressing audio information and storing it on a videodisc, a large number of lessons can be placed on one side of a disc. We expect that EIDS will eventually replace most of the 35-mm and 16-mm motion-picture film, the video-cassette players, and, more important, the paper-based manuals used in army training.

Surrogate travel was first explored by the Massachusetts Institute of Technology on a videodisc it produced of Aspen, Colorado. Using this disc, you can take a simulated drive through Aspen; at each intersection you have the option of going straight through or turning right or left. This concept is being adapted by the Advanced Research Projects Agency of the Department of Defense to reproduce the floor plans of all U.S. embassies on videodiscs. The training potential for a rescue mission, should we have another embassy captured, is very great.

In short, the uses of the videodisc seem to be more constrained by lack of imagination on the part of the users than anything else. So far we have really only scratched the surface of what this new medium is really capable of doing, not just in the fields of training, but in almost any application involving the storage, transmission, or display of information.

Robert Puttcamp
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How can I become a computer repair technician? It seems to be a growing field of employment.
P. Morton, Chicago, IL

Computer technicians are in great demand now, and the trend can only continue as more and more families and businesses buy personal computers. One vocational training firm, ITT Educational Services Inc., has about 5000 students now enrolled in computer repair programs. "And we still can't keep up with the demand from industry," says David O'Donnell, director of marketing at the firm's central office.

Becoming a qualified computer repair technician is not as difficult as you might think. For starters, you need a high school diploma and an aptitude for mathematics. Much of the electronics theory requires that you be comfortable with algebra and trigonometry.

Beyond that, you need direct instruction and supervised practice in electronics. You can get this at a community college, vocational institute, or even through home study. Many individuals garner the necessary experience during military service.

For more information about vocational institutes and home-study programs, see "Where to Get the Training" above.

After completing this academic training, you should have a basic understanding of electronics theory, the ability to read a schematic illustration, experience with common testing equipment, and skill at soldering and other required mechanical operations.

You don't need specific knowledge about particular computer models; employers (manufacturers, computer stores, and third-party repair firms) will provide the necessary hands-on training on the computers they repair.

Radio Shack's training program is a good example. The company operates 292 computer repair facilities (as of last April). To staff these centers, Radio Shack maintains a continuous training program for new computer repair employees.

After an employee completes an initial 30- to 60-day stretch at a local repair center, Radio Shack brings him or her to its headquarters in Fort Worth, Texas, for further classroom training. A 2½-week session covers field service, and another 5-week session covers component-level repair. According to Bud McClure, director of repair at Radio Shack, several hundred employees complete this program each year, a number that is increasing all the time.

What are the opportunities for a beginning technician? With the academic background we've described, you should be able to land an entry-level job with a computer repair firm at an annual starting salary of $13,000 to $15,000. You can expect $16,000 to $19,000 if you have an associate degree in electronic engineering from a good college or vocational program.

Most new repair technicians start out in field service, which is less demanding than bench-test repair. Servicing microcomputers is quite different from working on minicomputers and mainframes primarily because the smaller units don't have sophisticated diagnostic tools. Such devices, or specially designed interfaces for them, are often built right into the larger machines. With microcomputers, however, it is not cost-effective to build in complex diagnostic equipment or to design interfaces specifically for diagnostic work.

As a result, microcomputer field service (repairing and maintaining equipment at the customer's premises) is limited to replacement of printed-circuit boards and other gross modules of a system, which is a comparatively simple operation. Field service is thus a good starting position for new technicians.

More advanced (and higher-paying) work involves trouble-shooting and repairing on a component level—for example, isolating and replacing a defective memory chip so that an entire module becomes usable again. This "bench work" is usually done at the repair facility. Component-level repair technicians can make $19,000 to $25,000 or more depending on experience.

Where are the jobs? A few of the larger manufacturers such as Digital Equipment, IBM, Radio Shack, and Texas Instruments provide their own service bureaus or "depot repair" centers. You can apply for work at any of these manufacturer-operated service centers.

Many independent computer dealers as well as franchises provide their own repair facilities with support from the manufacturers, and you should consider any of

Where to Get the Training

Resident vocational schools have campuses around the country offering courses specifically in computer repair. Here are the central addresses of four of the largest programs:

- Control Data Institute, attn: Marcia Appel, HQC2AX, 8100 34th Ave. S, Minneapolis, MN 55440
- Devry Institute, Bell and Howell Inc., Dept. 5802, 2201 West Howard St., Evanston, IL 60202
- ITT Institute, attn: David O'Donnell, 3500 De Pauw Blvd., POB 68888, Indianapolis, IN 46268
- National Education Corporation, Inquiry Dept., 4361 Birch St., Newport Beach, CA 92663

Home study is a way to get computer repair training even if you can't attend a resident vocational college. Here are three sources:

- Cleveland Institute of Electronics Inc., 1776 East 17th St., Cleveland, OH 44114
- National Technical Schools, 4000 South Figueroa St., Los Angeles, CA 90037
- NRI Schools Inc., 3939 Wisconsin Ave., Washington, DC 20016

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Where the Jobs Are

Computer manufacturers operate repair and field service centers around the country. Central addresses are given below.

- Burroughs Corporation, Burroughs Place, Detroit, MI 48232
- Digital Equipment Corporation, Field Service Group, 146 Main St., Maynard, MA 01754
- Hewlett-Packard, 3000 Hanover St., Palo Alto, CA 94304 (4-year electronic engineering degree required)
- IBM, 1133 Westchester Ave., White Plains, NY 10601
- Texas Instruments, Data Systems Group, POB 1444, MS 7781, Houston, TX 77251
- Radio Shack Personnel Department, 500 One Tandy Center, Fort Worth, TX 76102

Third-party maintenance firms provide field service and depot repair work for microcomputers. They offer expanding career opportunities for repair personnel. Some of the larger operations include the following:

- RCA Data Services Inc., Building 204-2, Rt. 38, Cherry Hill, NJ 08002
- Sorbus Service Inc., 50 East Swedesford Rd., Frazer, PA 19355
- TRW, Human Relations Department, 15 Law Dr., Fairfield, NJ 07006
- Western Union Field Service Division, attn: Al La France, One Lake St., Upper Saddle River, NJ 07458

Authorized repair centers at many computer retail stores repair the products they sell. These centers are responsible for hiring their own repair technicians.

these computer stores a potential employer. Pay scales at individual stores tend to be lower than at large manufacturers and third-party service firms, but entry requirements may be more flexible.

Third-party maintenance firms are the newest entry into the microcomputer repair market, and they offer excellent career programs for electronics technicians. The companies usually operate under contract from a manufacturer to repair that company's equipment.

RCA Service Company, for example, has an exclusive agreement with Apple Computer Inc. to provide field service for Apple machines in corporate installations. According to Joe Albert, training manager at RCA, the company will be needing a large influx of new technicians to handle the increasing work for companies such as Apple.

Names and addresses of third-party computer maintenance firms are given above. You should consider all of them as potential employers.

To sum up, microcomputer repair offers excellent long-term job opportunities with a relatively modest investment in academic training.

In programs for TRS-80 BASIC and other common implementations of Microsoft BASIC, the following keyboard input routine is often used:

```
10 A$=INKEY$
20 IF A$="" THEN 10
30 PRINT A$;
```

The routine allows you to input characters without having the INPUT prompt appear on the screen. How do you accomplish this in a dialect such as Applesoft BASIC, which has no INKEY$ function?
Wyatt Johnson, Lafayette, LA

The PEEK and POKE commands, which address the Apple hardware directly, can be used to get around this limitation. Here's how to program the routine in Applesoft BASIC:

```
10 A=PEEK(49152)
20 IF A<128 THEN 10
30 POKE 49168,255
40 A1$=CHR$(A)
50 PRINT A1$;
```

Line 10 reads the contents of the keyboard data register. If a key has been pressed, the register contains the key code, a number greater than 128. If no key has been pressed, the register contains a value less than 128.

Line 30 resets the keyboard data register. This is necessary to prevent the program from reading the same character again and mistaking it for a newly entered character.

Do any of the online information services provide graphic data such as charts and diagrams?
Charles Kenwood, Lincoln, NE

With a couple of exceptions, The Source, Compuserve, and other information utilities in the United States are limited to black-and-white text. This is because all the services use ASCII (American National Standard Code for Information Interchange), which was not designed for the transmission of color and graphics information.

Two exceptions are Texnet on The Source and Microquote on Compuserve. Texnet is provided to The Source by Texas Instruments for use by TI-99/4A owners. It allows users to send and receive color graphics information.

Microquote, the financial information service available on Compuserve, has a Telidon option for users with Telidon-compatible computers and terminals. With this option you can receive financial data in the form of charts and graphs. Presently, the only American microcomputer that can handle Telidon communications is an Apple II outfitted with an interface board manufactured by Norpak Corporation, a Canadian firm. For more information on the Apple Telidon board, contact your local Apple dealer.

Two-way videotex systems that *can* provide color and graphics include the British Prestel and Canadian Telidon.

Individuals wishing to try out the Prestel system can contact Torch Computer Corporation (61 Commerce Way, Woburn, MA 01801), which operates an online database and can direct you to Prestel software for Apple, IBM, and Radio Shack computers. Other than a 300- or 1200-bit-per-second modem, no special hardware is needed. Torch also sells a computer with a modem and videotex software built in.

Compuserve's Microquote service is the only Telidon product now available to the public in this country, although several Telidon-based videotex field tests are now in progress.

An example of the graphics available on Prestel videotex.

What is the difference between assembly language and machine language?
Randal M. Roe,
Syracuse, IN

Machine language consists of binary numbers representing instructions and data for a microprocessor. As its name implies, it is for use by machines (microprocessors) rather than by humans (except under duress—it is tedious to read or write). Machine language looks like the following example, except the numbers are stored in binary form inside the computer's memory rather than represented on paper using figures:

```
00111010
00000011
10000000
```

This is Z80 machine language for "load the accumulator with the contents of memory location 32771." The first number is the load instruction, and the next two numbers indicate the address. (The accumulator is a special register inside the microprocessor for performing operations on 1-byte quantities.)

Assembly language allows you to create machine language programs without the tedium of using absolute numbers; instead, you can use easy-to-remember instruction names and symbolic references for data and memory addresses. The assembly-language version of the instruction given above might be the following:

```
LD A, MEMLOC
```

LD A ("load the accumulator") is easier to understand than 00111010, and MEMLOC is a name chosen by the programmer to stand for an address defined elsewhere in the assembly-language program.

The only problem with assembly language is that machines cannot process it directly—an assembler program must first translate it into machine language.

Because machine language is so tedious and difficult to use, no one really programs in it except when making minor changes to an existing program. Instead, when a machine-language program is needed, you use assembly language to create it.

Due to the close relationship between assembly language and machine language, the two terms are often used interchangeably. "I wrote a machine-language program" usually means "I wrote an assembly-language program and then had it assembled into executable machine language."

Reader Feedback: Sinclair Arrays

Several TS-1000 and ZX81 readers took exception to our discussion of arrays in Sinclair BASIC (May 1982, page 16). They pointed out that Sinclair BASIC *does* allow multidimensional string and numeric arrays.

The program we presented works fine—but it's unnecessary. To get a 5 by 10 array of strings in which each element has a maximum length of 20, use a statement such as DIM T$(5,10,20).

To refer to an element in this array, use something like PRINT T$(2,3), which prints out the string at row 2, column 3.

Arrays with more than two dimensions are handled similarly. A statement such as DIM T$(2,3,4,10) creates a 2 by 3 by 4 array of strings with maximum length 10. □

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Computer Lab or Caribbean Cruise?

"Micro People" sounds like the name of a raucous new-wave group, but it's actually a business that provides computer instruction aboard spacious sailboats roaming Caribbean coves. The Micro People are three Washington, D.C., entrepreneurs: William Trayfors, Noel Berge, and Nancy Berge. Trayfors doubles as ship's captain and chief computer instructor, and Noel Berge also pulls double duty as a deck hand and teacher.

The Micro People's week-long floating workshops cost roughly $1500 per person (exclusive of airfare to Florida), and the number of students is determined by the size of the sailboat. The first Micro People voyage was to the British Virgin Islands aboard a beautiful 46-foot sloop fully equipped with creature comforts such as fluffy towels, private cabins, snorkeling gear, a dinghy with an outboard, and a well-stocked spirits locker—not to mention the generator that powered the Apple IIs and Kaypros secured below. Gourmet meals were prepared by Nancy, who is computer-literate enough to be a teacher if either Bill or Noel falls overboard.

On that first cruise, mornings were devoted to workshops on computerized spreadsheets, database management, and word processing. Around noon, Trayfors and crew would set sail for the next secluded cove. After dropping anchor in mid-afternoon, the students were free to swim, snorkel, or venture inland. After dinner, students could either resume the computer sessions or mix a tropical rum drink—or both.

Student John Grierson, who plans to use microcomputers in his management job in the Philippines, felt the voyage was worth every penny. "We worked in splendid isolation from the twentieth century," he recalls. "No phones, no traffic, no telexes—the setting enabled us to immerse ourselves in the twenty-first century. It was incredible!"

Classmate Jim Parker also has pleasant memories of his week as a saltwater hacker. "In terms of programming know-how, I'm now light-years ahead of where I was when I got on that boat. And I even learned a little bit about sailing as I was considering the meaning of SYSGEN."

The Micro People's most recent voyage was aboard a 70-foot motor sailer. The trio schedules one workshop a month, and more details are available from The Micro People, 805 Devon Place, Alexandria, VA 22314; (703) 548-3849. □

Computer Loans, Discounts for Students

A very satisfying trade-off is happening in higher education today: colleges, hungry as always for tuition dollars, are offering interest-free loans and other special deals to students wanting to buy personal computers. Some colleges are even bending

Photographs by W. Trayfors

over backward to accommodate students who merely want to rent a computer or avail themselves of the campus computer labs.

This mutually advantageous trend is "starting to mushroom right now," says Ed Metro, a spokesman for the Personal Computer division of Digital Equipment Corporation, one of the biggest vendors in the educational market. In addition to the potential for increased enrollment, reports Metro, most colleges and universities across the country "really have a good understanding of how personal computers can be beneficial to the entire educational process."

Some schools have programs that offer discounts ranging from 18 to 30 percent off the retail prices of computers, while others go a step further and offer interest-free loans. In New England, Hampshire College offers a three-year interest-free loan while Amherst, Smith, and Mount Holyoke offer interest-free loans of a similar term that cover two thirds of the hardware costs of microcomputers. Western New England College in Springfield, Massachusetts, was concerned that students were becoming more computer-literate than the faculty and now offers its staff members three-year interest-free loans on top of 18 to 20 percent discounts. The response has been quite enthusiastic.

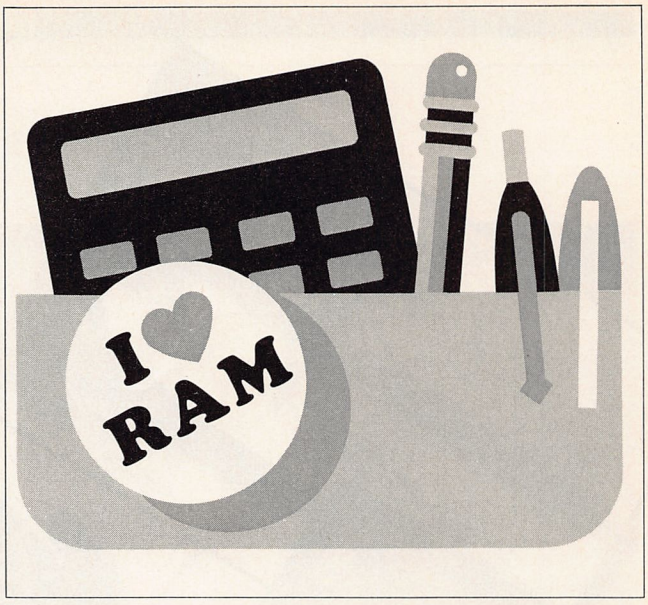
Here's a brief roundup of other programs under way across the country:

- Boston University faculty members and students can buy either IBM or Digital personal computers at a 25 percent discount. BU expects to sell as many as 1000 units this year.
- Faculty and students at Georgia Tech who show a valid school ID can buy IBM Personal Computers at a 23 percent discount from a local merchant, and a support group offers free consultation to anyone on campus.
- Cerritos College, a Los Angeles area school with 23,000 students, has perhaps the best deal of all. Not only is tuition free, but the school sells Digital computers through the college bookstore at 30 percent off.
- Interestingly, Cleveland's Case Western Reserve University—a school noted for its math and computer science departments—feels that it is economically and educationally more feasible to set up a personal computer center and have students lease machines for dorm use. Dorms here consist of six-student suites with common living rooms, and the cost of leasing one computer among six students works out to be about $20 a month per student. Case Western officials believe that similar computer-sharing programs will be the route most schools take in the long run. □

What's an Apostrophe?

Cathy Gort, a kindergarten teacher in Lake Stevens, Washington, says that teaching computer basics to 5-year-olds is not without its humorous rewards.

Consider, for example, one of Gort's more precocious students, who has taken to his Apple II like a fish to water. While reading aloud to his classmates, the little fellow got stuck on the word "don't." After struggling a moment with the unfamiliar apostrophe, he confidently blurted, "Don, shift seven, tee!" □



Computer Sequels to Novelty Hits

It can be argued that capitalism 1980s-style is simply a matter of cashing in on the folks who cashed in one year ahead of you. For example, a couple of enterprising Arizonans have created computer sequels to two of the eighties' biggest pop phenomena: the Preppie and the Valley Girl.

After Patty Bell and Doug Myrland knocked off a novelty record called "Silicon Valley Guy" (lyrics full of computer jargon and Santa Clara County in-jokes set to the tune of Frank and Moon Unit Zappa's hit record "Valley Girls"), they collaborated on a book entitled *The Official Silicon Valley Guy Handbook*. The $3.95 paperback, published in June by Avon Books, apes the format of Lisa Birnbach's best-selling *The Official Preppie Handbook* (Workman, 1980), which itself stole liberally from John Updike. (Originality, you see, isn't a prerequisite for collecting royalties.)

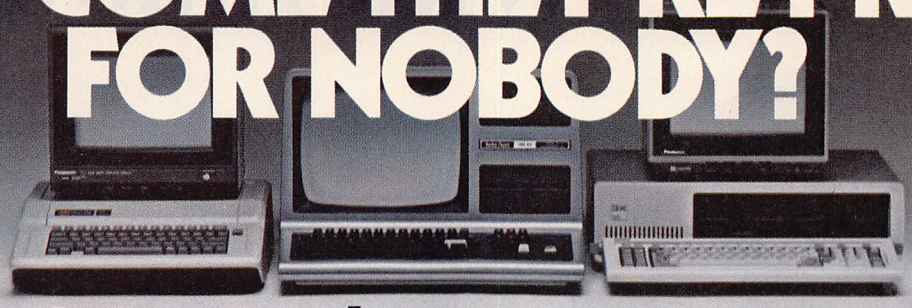
Not surprisingly, authors Bell and Myrland aren't seasoned hackers. Bell is an aviation coordinator for a company in Chandler, Arizona (which means, essentially, that she's a pilot who ferries planes from one airport to another). Myrland is program director for radio station KMCR-FM in Phoenix and has worked in radio for the last 12 years. The pair met when Myrland did a radio interview with Bell concerning another offbeat chapter in her life: a group she had formed called The Very Bad Poets Club. After joining pens, Myrland and Bell enlisted the aid of Bob "The Glaze" Glazar, who sang the lead vocal on their novelty record and portrays a character called Ray FIFO (first in, first out) in the book's photos.

The zany trio is distributing the novelty record on its own newly created label. The record, along with a tongue-in-cheek glossary of computing terms, has been marketed via direct mail for the most part, although it can be found in record bins in both the Phoenix and San Jose areas. If the book is successful this summer, says Myrland, they'll press more copies of the record and try to market it all over again.

"The book is basically a satirical look at life-styles in the computer industry," says Myrland. "It's a guide for all these fresh-out-of-college people who suddenly have to deal with real life

Illustration by Daniel Pelavin

IF PERSONAL COMPUTERS ARE FOR EVERYBODY, HOW COME THEY'RE PRICED FOR NOBODY?



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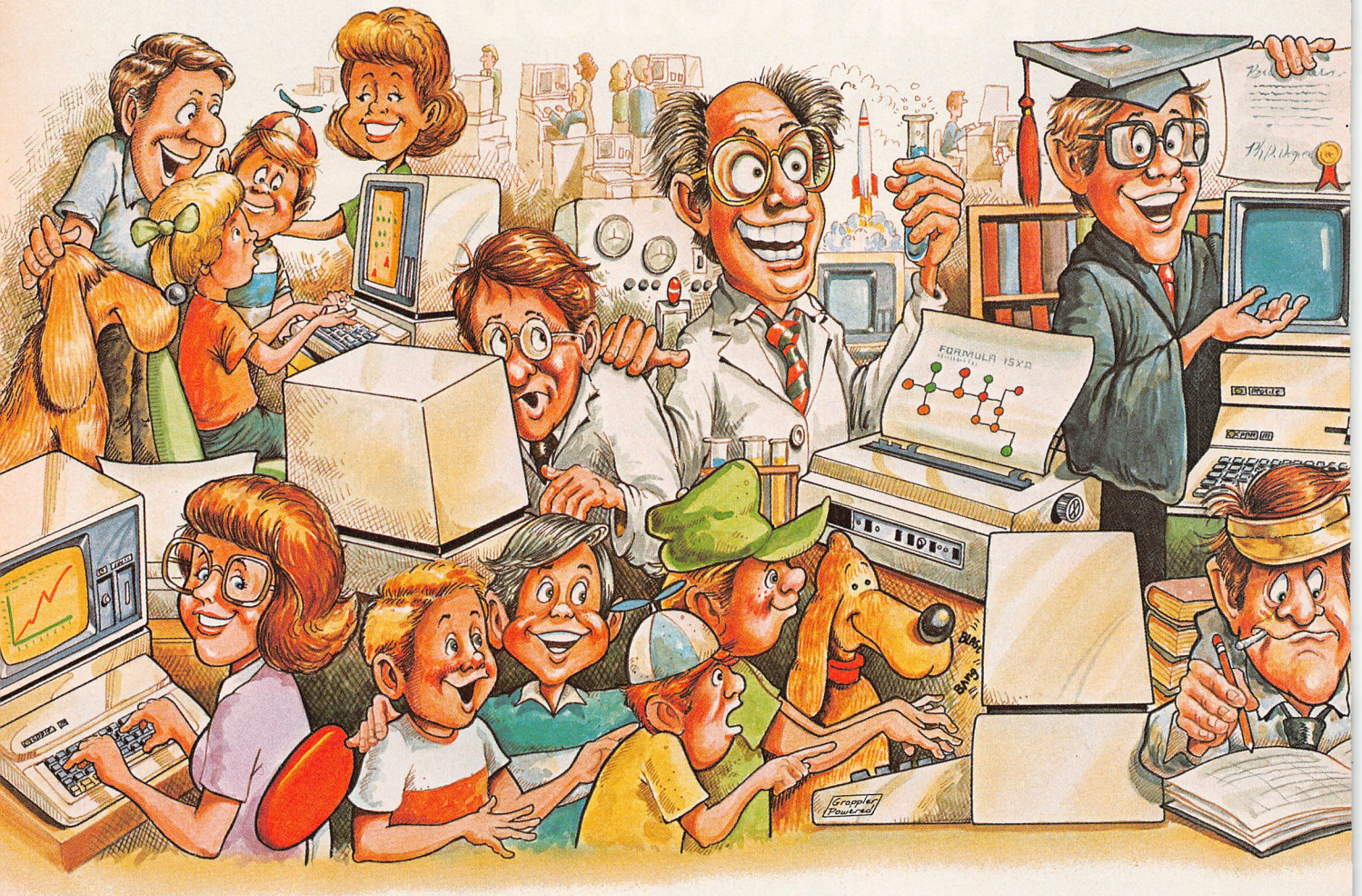

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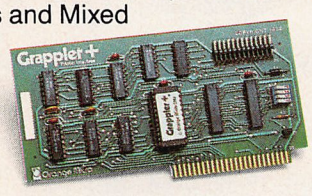

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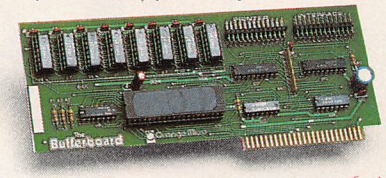

*Versions for standard Grappler + , Epson APL and Apple Parallel Interfaces.

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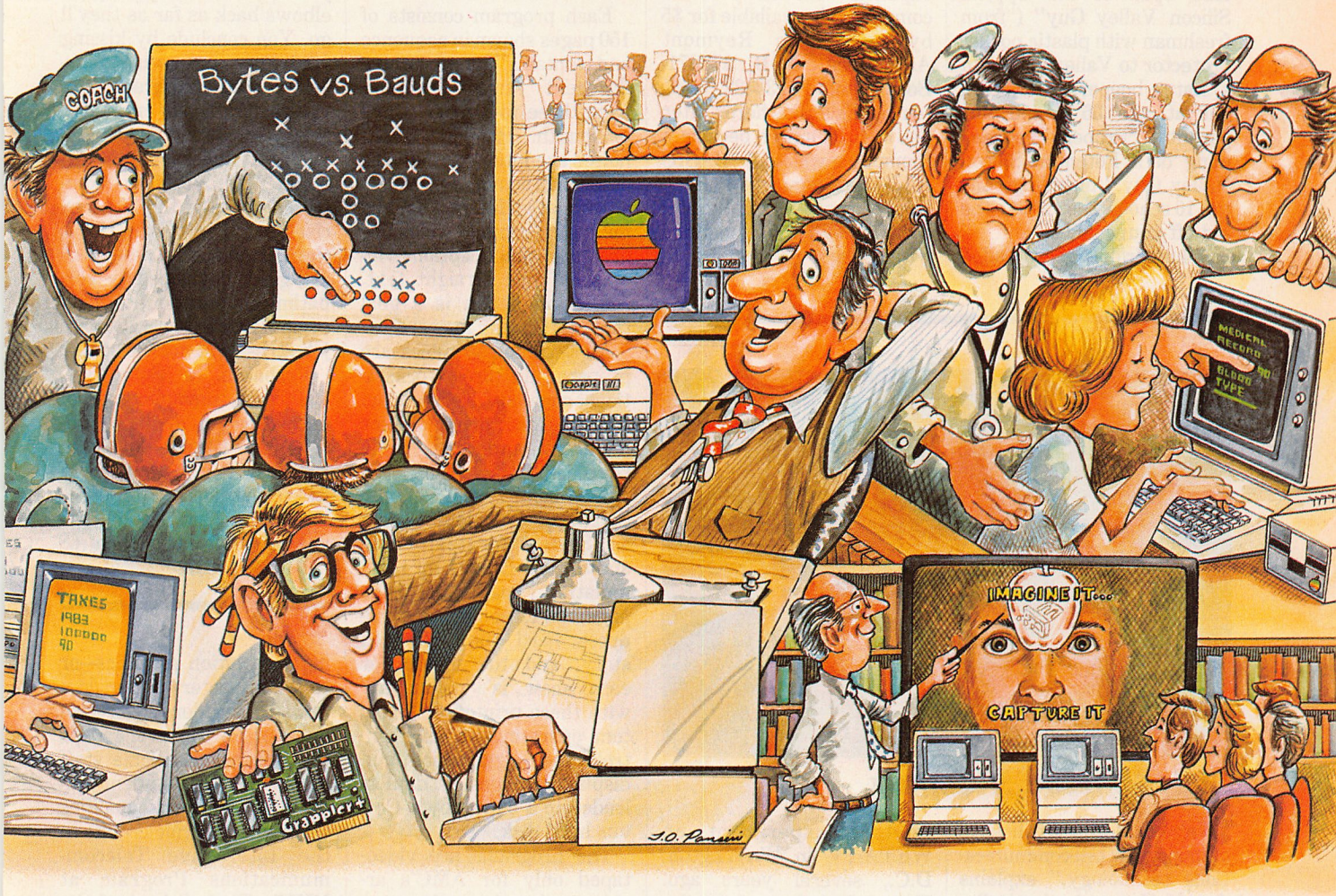

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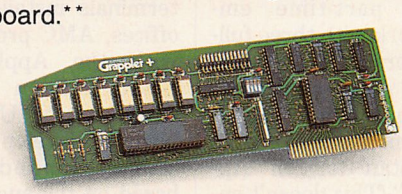
The most sophisticated buffered Apple printer interface available. The New Buffered Grappler + combines the industry leading features of the Grappler + with the time saving economies of the Bufferboard.**



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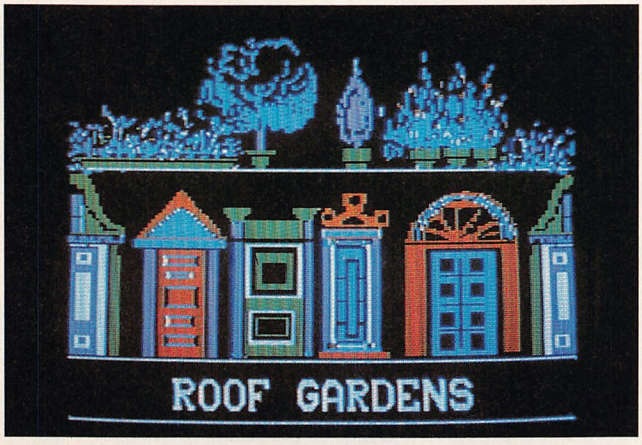
after years of dealing only with computers." The topics covered include "Interfacing with Units of the Opposite Sex," "The Short-Circuit Life Span of the Typical Silicon Valley Guy" ("from freshman with plastic pocket protector to Valley Guy with a status beeper, then burnout at age 35"), and, for parents, "Proper Programming of a Potential Silicon Valley Guy," including "the top 10 schools that'll take the kid off your hands."

A humorous record called "BASIC Ain't the Language of Love"—a country-and-western ballad about how a couple's romance is threatened by the man's preoccupation with his personal computer—is available for $5 by mail from Reymont Associates, POB 273271, Boca Raton, FL 33432. Written by Felicia Scherer after her own daughter became a "computer widow," "BASIC Ain't the Language of Love" has been used by IBM to add a little levity to meetings with dealers. □



Civic-Minded Videotex

"We're exploring fresh ways of using new telecommunications technology," explains Ann McKay enthusiastically, "and one important application is community service." McKay is project manager of "Apple Bytes," a 15-minute videotex community-information program that airs on New York City's Manhattan Cable TV system. The text and graphics for "Apple Bytes" are produced on Apple II systems by the Alternative Media Center (AMC). AMC has production facilities on the New York University campus and is funded principally by grants from the Charles Revson Foundation.

The embryonic version of "Apple Bytes" was AMC's teletext experiment on WETA-TV in Washington, D.C., several years ago. That initial foray into the realm of teletext gave AMC plenty of ideas on how to expand its service into a videotex community-affairs program.

Community organizations affiliated with "Apple Bytes" include the NYC Department for the Aging, the Association of Hispanic Arts, Youthnet/Family Life Theatre, the Citizens Committee for NYC, United Parents Association of NYC, the New York Public Interest Group, and the Neighborhood Open Space Coalition. Some groups simply furnish material to be broadcast on "Apple Bytes," but volunteers from other groups actually direct production of their particular segments. The show's high-resolution color graphics add plenty of pizzazz to announcements of upcoming events, local news items, and editorial comments.

Each program consists of 150 pages shown in sequence and contains ten to twelve different stories ranging from three to twenty pages in length. Random traffic noises are interspersed with other city sounds to provide an offbeat audio track for the messages, some of which use graphics and captions instead of just straight text. Actual animation is a goal that AMC looks forward to.

All text and graphics are prepared on three workstations, each outfitted with an Apple, a disk drive, a color monitor, and an Apple Graphics Tablet. The programs come from Penguin Software: Complete Graphics System for text entry and Special Effects for manipulating images on the page. An Epson printer produces hard copy of each story, and the lineup for each show is "paginated" with these printouts. A custom operating system controls the organization and display of pages as data is loaded to a 5-megabyte Corvus hard disk.

The programs are videotaped only for AMC's archives. As show time approaches, the latest edition is transferred to an Apple employed exclusively for transmitting the signal directly over phone lines to Manhattan Cable's studio. From there it's piped out on a public-access channel that costs AMC absolutely nothing.

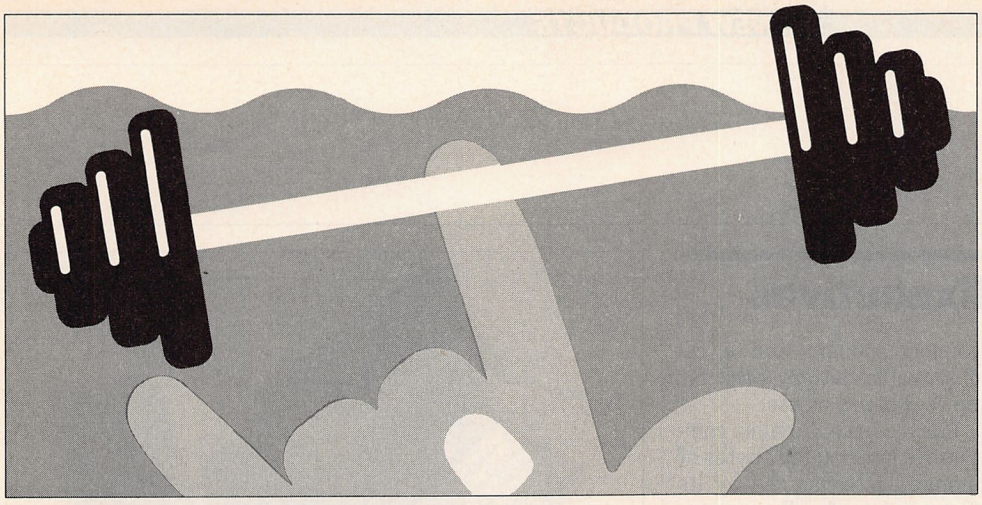
Several part-time employees work with three full-time staffers on text entry and page preparation. Experience in computer graphics programming is a prerequisite for staff work on "Apple Bytes." (This doesn't apply to the skilled artists who create many of the brilliant high-resolution graphics—or to the teenagers and even a few first-graders who produce art for the civic groups they represent.) Some staff members are student interns whose work qualifies them for academic credits in the Interactive Telecommunications Program at NYU's Tisch School of the Arts. "It's really a marvelous opportunity for students to get practical experience in the field of telecommunications," says McKay.

Four of the civic organizations working with "Apple Bytes" are also taking part in another AMC project. Through TRS-80 videotex terminals installed at their offices, AMC provides them with the Apple Bulletin Board System via phone lines from NYU. AMC has plans to develop other community-minded projects based on the success of this computer-conferencing system. □

Workstation Workout

You begin by wobbling your shoulders, arms, thighs, and feet. A moment later, you place your hands behind your neck and pull your elbows back as far as they'll go. You conclude by kissing your knee and giving yourself a warm embrace. No, you're not in an encounter group or a gymnasium—you're at the computer terminal. You've just completed three of the 20 exercises found in "Tone Up at the Terminals," a new exercise guide developed by Verbatim Corporation to help computer operators alleviate job stress and muscle strain.

Verbatim, a Sunnyvale, California, manufacturer of data-storage media, published the 12-page booklet in response to the findings of its recent survey of office workers. That study revealed that more than 68



percent of the 1263 respondents had health concerns about the computer and word-processing equipment they operated. Sixty-three percent said they experienced eyestrain; 36 percent cited back strain, and nearly 8 in 10 of those polled wanted regular breaks and better lighting.

"There is little evidence to suggest that machines are the culprits," says Malcolm B. Northrup, Verbatim's president and chief executive officer. "Rather, elements in the working environment, work pressures, and the amount of time spent at the machines have some bearing on the physiological strain felt by many office workers."

Northrup believes that periodic exercise breaks will help computer operators combat stress while increasing concentration and boosting their performance levels.

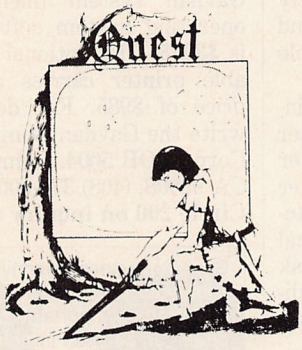
Following its survey, Verbatim commissioned exercise physiologist Denise Katnich to design the exercise regimen for "Tone Up." She devised 20 exercises that run the gamut from undemanding finger stretches that prevent hand cramps to robust trunk twists worthy of Jack La Lanne. All the exercises can be performed within a few feet of your terminal.

But won't your fellow workers find it distracting when you do pectoral stretches and derriere firmers at the workstation? "They might also find it stimulating," chortles Donovan Neale-May of Dudley/Anderson/Yutzy, Verbatim's public relations firm. "But seriously, some people *are* concerned that it might distract managers and fellow employees. In Japan, employee health and fitness is something that everyone just accepts. We hope this booklet will be a start in that direction."

To receive a free copy of the exercise guide send a self-addressed stamped envelope to Verbatim Corporation, Tone Up at the Terminals, 323 Soquel Way, Sunnyvale, CA 94086. □

AARDVARK

TRS-80 COLOR COMMODORE 64 VIC-20 SINCLAIR/TIMEX TI99



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32K TRS 80 COLOR Version $24.95.
Adds a second level with dungeons and more Questing.

BASIC THAT ZOOOMMS!! AT LAST AN AFFORDABLE COMPILER!
The compiler allows you to write your programs in easy BASIC and then automatically generates a machine code equivalent that runs 50 to 150 times faster.
It does have some limitations. It takes at least 8k of RAM to run the compiler and it does only support a subset of BASIC—about 20 commands including FOR, NEXT, END, GOSUB, GOTO, IF, THEN, RETURN, END, PRINT, STOP, USR (X), PEEK, POKE, *, /, +, -, >, <, =, VARIABLE NAMES A-Z, SUBSCRIPTED VARIABLES, and INTEGER NUMBERS FORM 0-64K.
TINY COMPILER is written in BASIC. It generates native, relocatable 6502 or 6809 code. It comes with a 20-page manual and can be modified or augmented by the user. $24.95 on tape or disk for OSI, TRS-80 Color, VIC 20, or Commodore 64.

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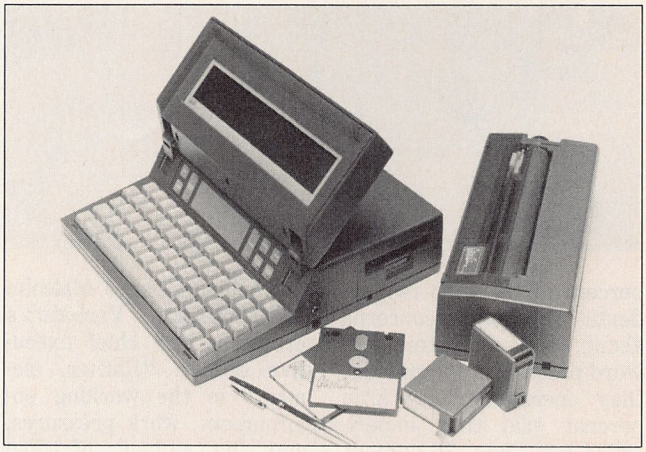
Gavilan Woos Executives

The Gavilan computer combines many of the features sought by executives who need a sophisticated portable workstation: it's lighter (9 pounds) and faster (16-bit) than many of its competitors, contains a built-in 3-inch microfloppy-disk drive, runs under the MS-DOS operating system, and has a touch panel that enables the user to move an on-screen pointer to the file or location desired. Best of all, it's tiny—only 11 inches square and 2¾ inches deep. Yet when unfolded, the Gavilan has a spiffy 8-line by 66-character flat-panel liquid-crystal display and a full-sized typewriter keyboard with a 10-key numeric pad. It also has a built-in 300-bit-per-second direct-connect modem and a rechargeable battery pack for up to 8 hours of use.

Most of the Gavilan computer's internal 80K bytes of memory is consumed by its "human interface" programming—those help, point, select, and command menus that make the machine easy to use. That leaves you about 32K bytes for creating memos or spreadsheets. You can add up to 128K bytes of memory by purchasing plug-in capsules.

The word "capsule" also describes the format of the Gavilan's applications software: Capsuleword (word processor), Capsulecalc (spreadsheets), Capsuleoffice (expense reporting, appointments, and so on), Capsulecomm (telecommunications software), and Capsuleform (for user-created forms).



The Gavilan computer—plus optional printer, microfloppy disks, and memory "capsules"—fits in any normal-sized briefcase.

The Gavilan company has also released a portable printer that prints out 80-character lines at a speed of 50 characters per second. Like the computer itself, the optional printer is extremely lightweight (5 pounds) and comes with a rechargeable battery pack.

Gavilan system options include an acoustic coupler modem, a vehicle lighter adapter that lets you power the computer off an automobile's 12-volt electrical system, and a second disk drive that provides an additional 320K bytes of formatted disk storage.

The Gavilan Computer Corporation got its name from a Northern California mountain range—the culmination of an exhaustive trademark search which revealed that virtually all the words that play off "soft," "porta," and "data" have already been trademarked. "Our search began with 242 possibilities," says Gavilan president Manny A. Fernandez, "and we were shocked to discover that only three of those names were internationally free of trademark constraints."

The company is targeting the Gavilan to executives and professionals who are looking for a complete mobile office in a briefcase. The price for the basic Gavilan system (including operating system software) is $3995. The optional portable printer carries a list price of $985. For details, write the Gavilan Computer Corp., POB 5004, Campbell, CA 95008, (408) 379-8000.

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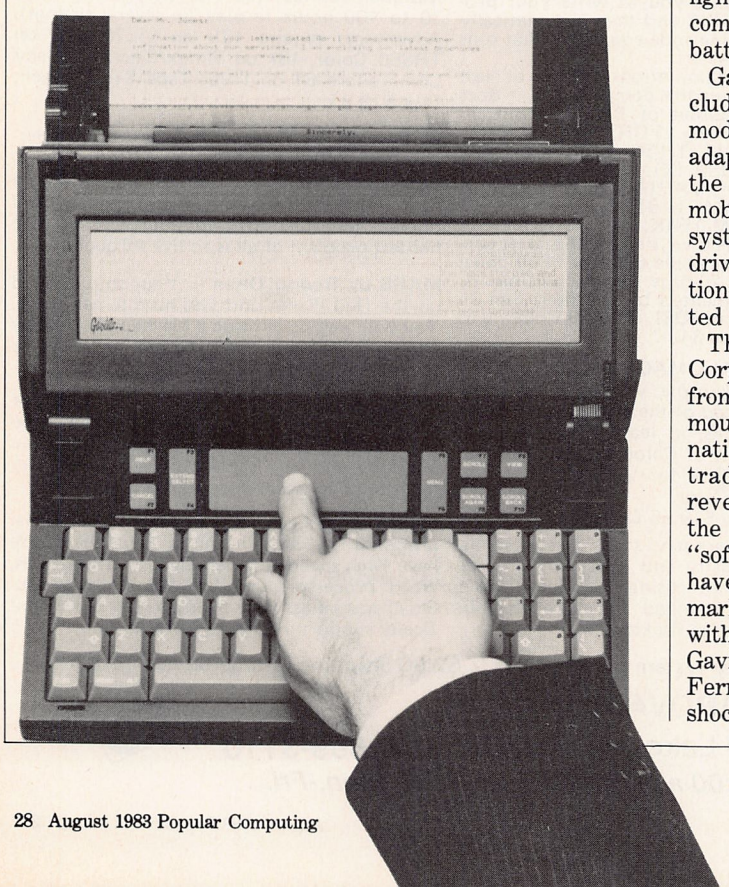
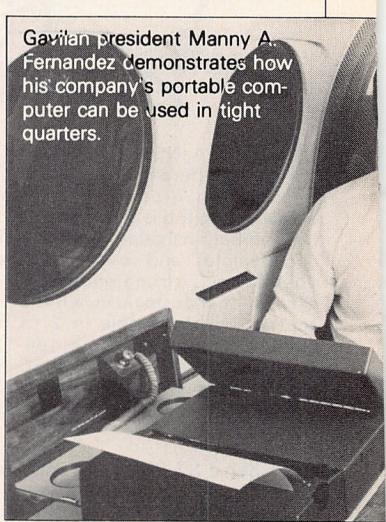
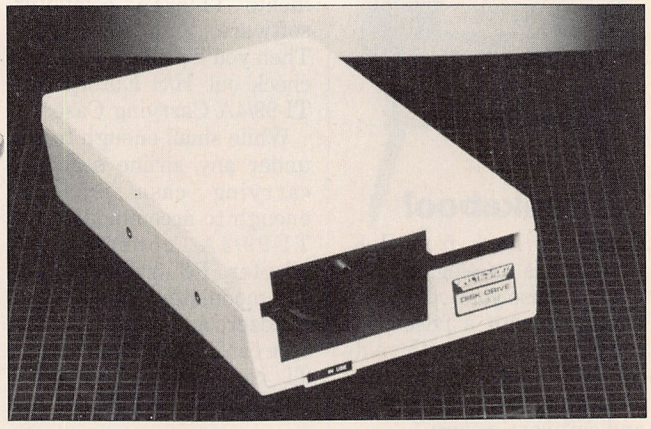
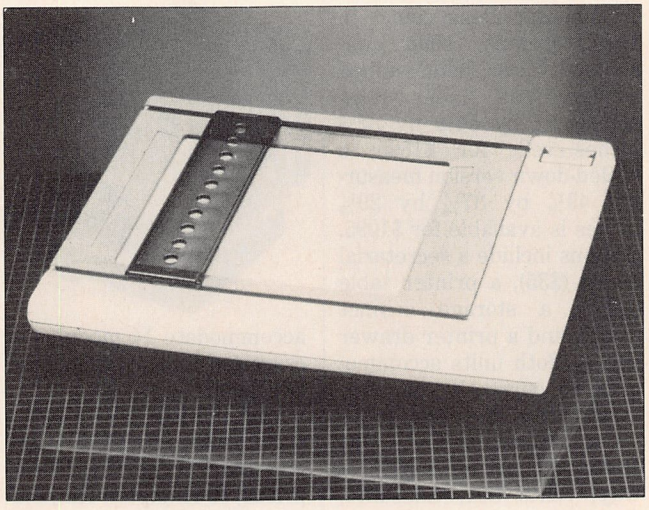
Gavilan's integrated touch panel lets you move an on-screen pointer.



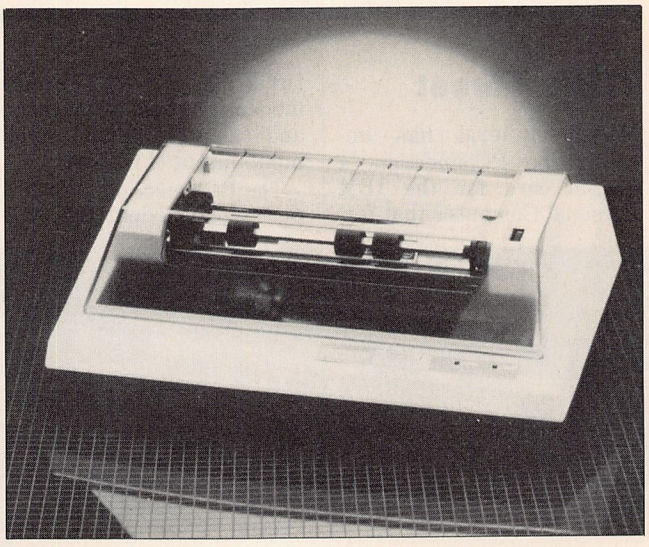


Gavilan president Manny A. Fernandez demonstrates how his company's portable computer can be used in tight quarters.





Spectra Video's SV-318 personal computer (top left) connects to a variety of peripherals, including a disk drive (top right), graphics tablet (above), and dot-matrix printer (below).



CP/M and a Built-in Joystick

Spectra Video's SV-318 is the first affordably priced personal computer system to offer a built-in extended Microsoft BASIC interpreter and the ability to run CP/M 2.2 and CP/M Plus.

Coming from the same company that markets the popular Spectravision line of video-game cartridges for Atari computers, the SV-318 is priced at $299.95 (an optional 5¼-inch disk drive costs $525). The unit features a Z80A microprocessor, 32K bytes of read-only memory, 32K bytes of random-access memory (expandable to 144K bytes), a built-in joystick, 256 by 192 high-resolution graphics, a separate game-cartridge slot, plus an on-screen program status line.

The SV-318 includes a 71-key standard-layout keyboard, upper- and lowercase characters, 52 graphics symbols, 10 user-defined function keys, a built-in word processor, and 16 keyboard-selectable colors. The screen uses a 40-character by 24-line display for text and a 32-character by 24-line display for graphics. Editing features include full cursor control plus insert and delete keys.

With the SV-318, Spectra Video is also introducing a complete line of peripherals. Among these are the SV-601 Super Expander ($175) that can connect the computer to seven input/output devices simultaneously, an 80-column dot-matrix printer ($499), a graphics tablet ($129.95), a 300/1200-bit-per-second telephone modem ($175), and a stereo data-cassette recorder ($89.95) that can store data on one channel and voice or music on the other.

For details, write Spectra Video, 39 West 37th St., New York, NY 10018.

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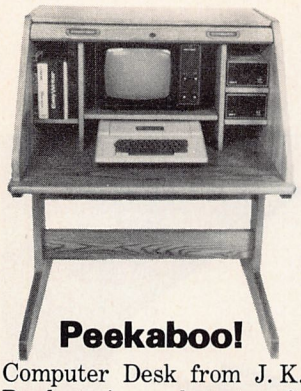

Peekaboo!

Computer Desk from J. K. Products is an elegant, safe way to house your computer. Designed with a false back to hold cables and with vents for proper cooling, the desk locks shut to keep hardware and software secure.

Computer Desk comes in two versions, each constructed from hand-rubbed solid red oak. A desk measuring 51 by 54½ by 32½ inches sells for $1595; a scaled-down version measuring 49⅛ by 37¼ by 29½ inches is available for $1095. Options include a secretarial board ($35), a printer table ($220), a storage cabinet ($105), and a printer drawer ($205). Both units accommodate all currently manufactured personal computers.

For details, write J. K. Products Inc., 3020 Bridgeway, Suite 351, Sausalito, CA 94965.

Circle 202 on inquiry card.

Take It Away

Looking for a way to safely transport your Texas Instruments TI-99/4A computer, software, and accessories? Then you'll probably want to check out H/S Enterprises' TI-99/4A Carrying Case.

While small enough to slip under any airline seat, the carrying case is large enough to accommodate the TI-99/4A console, AC adapter, RF (radio-frequency) modulator, speech synthesizer, and joysticks. The case can also carry either the TI cassette player and 7 cassettes or modules or can

accommodate 14 modules or cassettes and their instruction books.

The TI-99/4A Carrying Case costs $59.95. To find out more, write H/S Enterprises, 10 Hampton Rd., Suffern, NY 10901.

Circle 203 on inquiry card.

Doing It Graphically

SSM Microcomputer Products has introduced a parallel-printer interface card for the Apple II and IIe. The Appic/G card and accompanying Graph-It software disk enable users to transfer any high-resolution image from their system screen to a variety of printers.

Unlike other parallel-printer cards, which require that you buy additional firmware to interface different printers, the Appic/G lets you choose printer drivers from an on-screen menu. In addition to conventional screen copying, the package also supports reverse image, magnified graphics, page centering, and cropping. Owners of the Applewriter II word-processing program can use the system to add graphics, subscripts, and superscripts to their files.

The Appic/G card works under DOS (disk operating system) 3.3, CP/M, and Pascal; it is compatible with most Apple software. The card with software retails for $129. For further information, write SSM Microcomputer Products Inc., 2190 Paragon Dr., San Jose, CA 95131.

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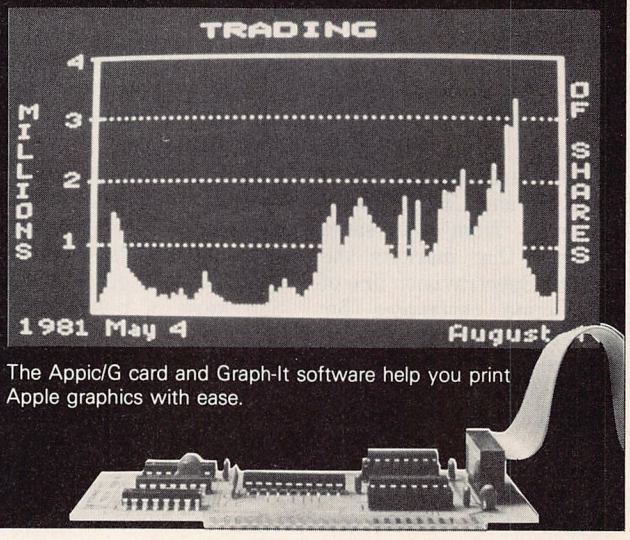

The Appic/G card and Graph-It software help you print Apple graphics with ease.

Triple Threat

Microperipheral has unveiled the PConnection, a plug-in card for the IBM Personal Computer that features a direct-connect modem, a real-time clock, and an additional serial input/output (I/O) port.

The PConnection's 300-bit-per-second modem (Bell type 103/113) features Touch-Tone or pulse dialing as well as auto-answer and auto-originate modes. The modem acts like an asynchronous card and contains an additional RS-232C port to let you connect additional serial-based devices.

The card's real-time clock manages timer loops and dialer routines. With its clock, the PConnection can automatically answer or dial numbers at preset times.

The PConnection with modem, real-time clock, and serial I/O port costs $375. The card with modem alone costs $279. For more details, write the Microperipheral Corp., 2565 152nd Ave. NE, Redmond, WA 98052.

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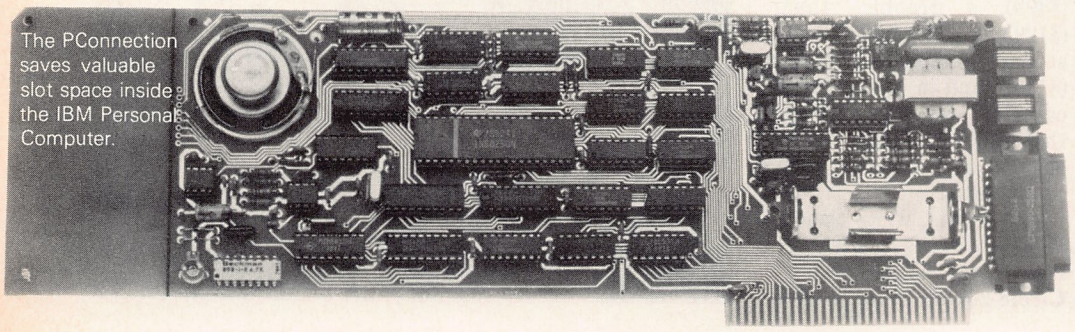

The PConnection saves valuable slot space inside the IBM Personal Computer.

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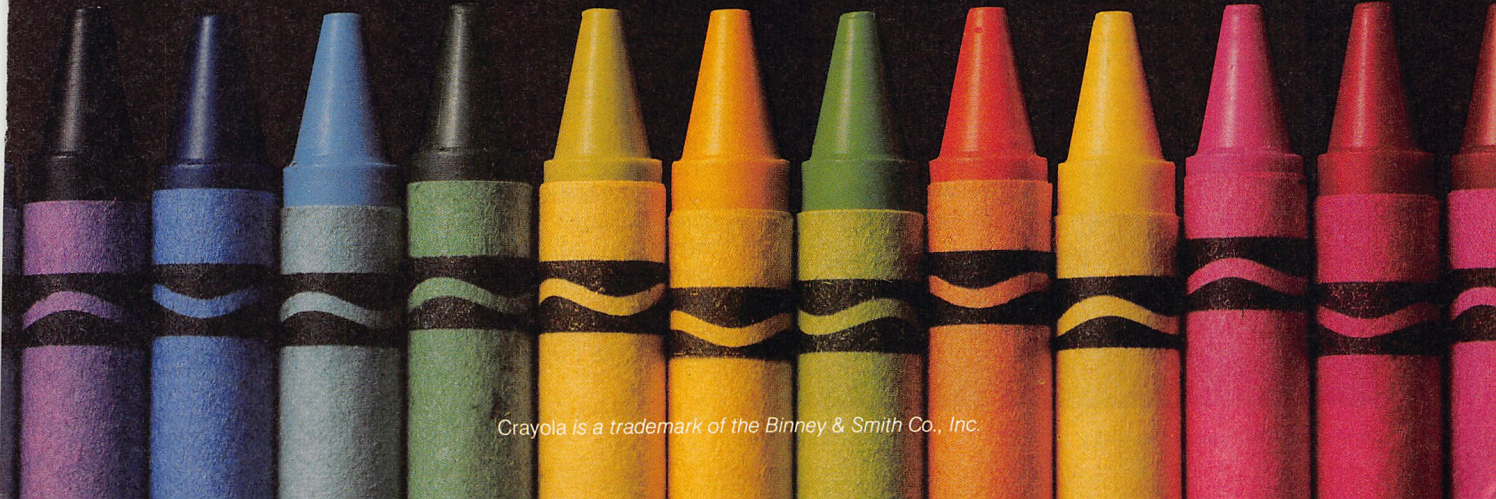

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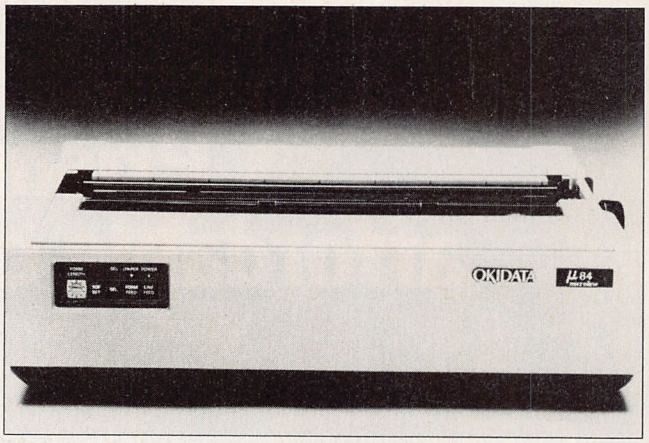


Oki Printer

The 136-column Step 2 Microline 84 dot-matrix printer from Okidata is an upgraded version of an old favorite. The new model now offers full compatibility with Wordstar, Visicalc, and many other popular software packages.

Standard features on the Step 2 include a switch-selectable interface, a select/deselect control, a Spanish character set, and forward-feed superscript/subscript printing. The Step 2 also offers 200-cps (character-per-second) bidirectional printing, a 50-cps correspondence-quality mode with proportional spacing, and control codes that are compatible with all Microline printers.

The serial version of the Microline 84 includes selectable transmission speeds, ready/busy protocols, and three different print modes. Both parallel and serial versions of the printer sell for $1495. More details are available from Okidata Corp., 111 Gaither Dr., Mt. Laurel, NJ 08054.

Circle 206 on inquiry card.

Bearing the Burden

The Grizzly provides an uninterruptible power supply and gives you peace of mind.

Electronic Protection Devices has introduced the Grizzly, a compact, maintenance-free, uninterruptible power system.

Equipped with a built-in automatic battery charger and sonar alarm, the unit guards your computer system against high-voltage transients. In case of complete electrical failure, the Grizzly supplies 20 minutes of 1000-watt power—enough time to save data, prevent hard-disk head crashes, and safely close down the system. The Grizzly retails for $895. For details, contact Electronic Protection Devices Inc., POB 673, Waltham, MA 02254.

Circle 207 on inquiry card.

Circle 4 on inquiry card.

Circle 44 on inquiry card.

Before you buy a printer look at the fine print.

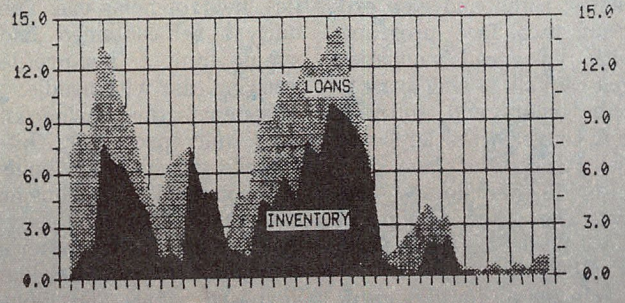
There's a big difference in printers, and the proof is right before your eyes.

This is an actual printout from Digital's Letterprinter 100. As you can see, it's good enough to send out to customers.

But that's not all the Letterprinter 100 can do. Suppose, for instance, you're in a hurry.

JUST PUSH A BUTTON AND YOU CAN PRINT OUT A WHOLE PAGE OF DRAFT COPY IN LESS THAN TEN SECONDS.

There are other fine points. You can see how the Letterprinter 100 can print multiple typefaces. It can also print in **BOLD**, **double-width** and condensed. And do all these styles automatically, without stopping. And with its wide range of graphics capabilities, you can even draw your own conclusions.



You simply can't find a more versatile printer than the Letterprinter 100. And it's just one of a family of printers we offer for Digital's personal computers and video terminals. Including a daisy-wheel printer, the LQP02, and a low-cost Personal Printer, the LA50, that still make you look good on paper.

So now that you've read the fine print, see our fine printers. Call 1-800-DIGITAL,extension 700, for the distributor near you. Or write Digital Equipment Corporation, Terminals Product Group, 2 Mt. Royal Avenue,UP01-5, Marlboro, Ma. 01752.

digital

Voice Box II for Atari computers, a speech synthesizer with singing and inflection.

Say Something

At $169, the Voice Box II is a low-cost, programmable speech synthesizer for Atari 400 and 800 computers with 32K bytes of random-access memory and a disk drive.

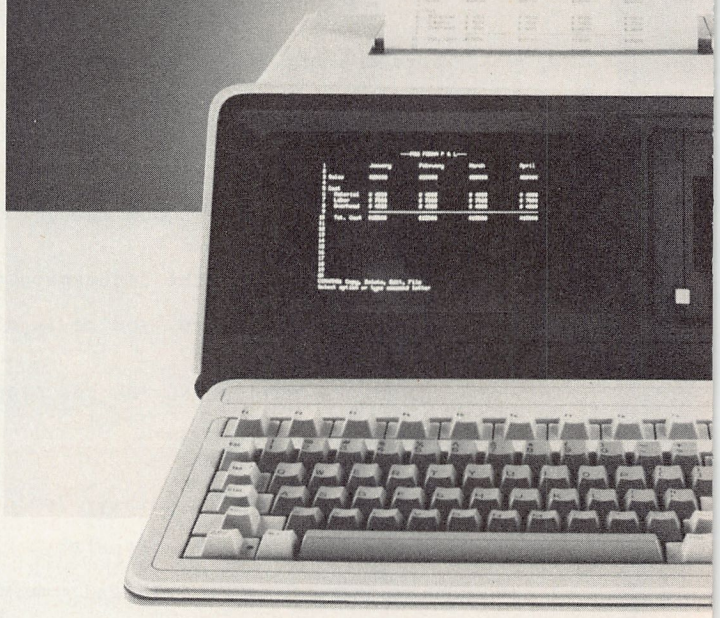
In addition to the usual speech-synthesizer abilities (such as converting typed characters into spoken words and inserting speech subroutines into programs), the Voice Box II can talk with inflection and speak in foreign languages. The synthesizer can even sing to the accompaniment of its own three-part musical score and includes sound effects such as tremolo and vibrato.

The Voice Box II comes with a wide variety of software. Included with the system are three talking games; a talk-and-spell program; two face programs with lip-synced animation that can talk or sing along to your input, and software that converts the keyboard into a 3½-octave piano.

For further details, contact The Alien Group, 27 West 23rd St., New York, NY 10010.

Circle 208 on inquiry card.

On the Dot



The Dot is a portable 16-bit computer designed for office, field, or home use. The unit is self-contained and snaps into a low-profile carrying case with handle.

System features include an 8088 microprocessor, bit-mapped graphics on a built-in 9-inch monitor, and one or two Sony 3½-inch floppy-disk drives. The computer's conventional typewriter-like keyboard offers 256 input characters and a numeric keypad. The Dot comes with a wide array of business software and an optional Z80 microprocessor that gives users access to programs developed for the CP/M operating system.

Dot system prices begin at $2995. Included in the minimum configuration package are 32K bytes of random-access memory (RAM), a monitor, a keyboard, one

Ramax, a VIC-20 memory and system expander.

Expanding the VIC-20

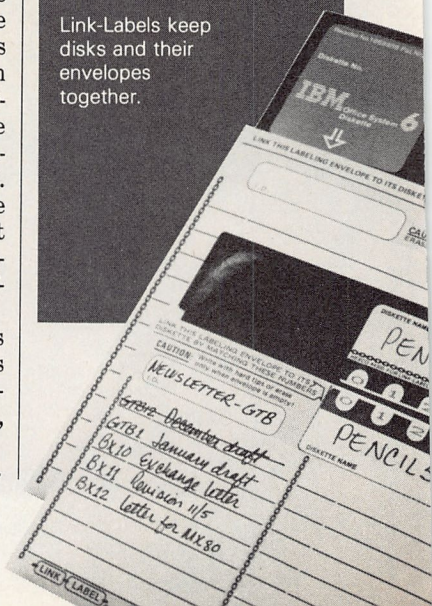
Ramax is a 27.6K-byte memory and dual-connector expansion system for use with the Commodore VIC-20. The $169 plug-in module replaces up to three random-access-memory cartridges and is identical to Commodore's memory-expansion connector (although Ramax can also enable or disable the computer's game-cartridge signal). Because Ramax's memory is switchable in 3K-byte or 8K-byte segments, the unit can interface with any plug-in device compatible with the VIC-20. Also included with the Ramax module are a reset switch, a memory and connector safety fuse, and a self-test program.

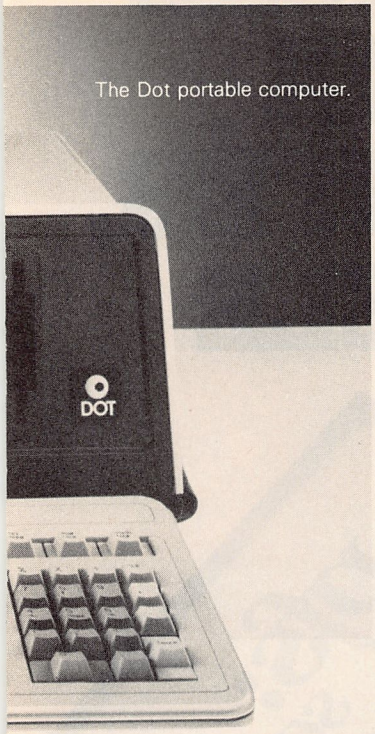
Further information is available from Apropos Technology, 350 North Lantana Ave., Suite 821, Camarillo, CA 93010.

Circle 209 on inquiry card.

Label It Linked

Link-Labels keep disks and their envelopes together.





The Dot portable computer.

disk drive, and two expansion slots. Options include an additional 32K bytes of RAM, two communications ports, an MS-DOS and BASIC software kit, a built-in 300-bps (bit-per-second) telephone modem, and a 160-cps (character-per-second) thermal printer. For details, write Computer Devices Inc., 25 North Ave., Burlington, MA 01803.
Circle 210 on inquiry card.

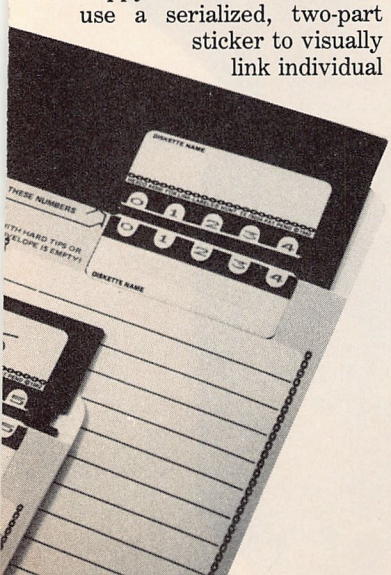
Morse Code for Apple IIs

Amateur radio operators, from Novice- through Extra-class, will be interested in the Code Machine, an Apple II software package that transmits and receives Morse code.

Easily interfaced with any radio transceiver, the Code Machine ($29.95) features a software-based audio filter that can tune out noise and adjacent-station interference. The program's receiving speed automatically adjusts to the sending station's transmission rate (6 to 60 words per minute). In the transmit mode, speed can vary from 15 to 60 words per minute in increments of 5 words per minute. A 320-character buffer lets the operator type ahead of the sending speed and store up to eight lines of incoming messages. A sidetone monitor lets you hear the code as it's being sent.

The Code Machine comes on a double-sided 5¼-inch disk and includes full instructions for installation and use. Further details are available from Cotec, 13462 Hammons Ave., Saratoga, CA 95070.
Circle 211 on inquiry card.

A combination disk label and storage envelope is now available for 5¼- and 8-inch floppy disks. Link-Labels use a serialized, two-part sticker to visually link individual disks to specific protective envelopes that include spaces for user comments on the front and back. The 8-inch disk jacket allows up to 52 entries; the 5¼-inch version accommodates up to 26 notes. For keeping track of inventory, serial numbers can be custom printed on the two-part linking stickers. The labels and envelopes come in five colors.



One dozen 5¼-inch Link-Labels sell for $6.75; the 8-inch version costs $10 per dozen. A trial sample package in either size is available for $2 from Hexco Inc., POB 199163, Hunt, TX 78024.
Circle 212 on inquiry card.

Look what I've got for you

a $39.95 Light Pen

for
- **COMMODORE VIC 20/64**
- **ATARI 400/800**
- **APPLE II**

Now you can make your computer come alive and free yourself of many keyboard strokes. Touch my light pen to your TV screen and draw or paint multicolored pictures or pick from a menu. It's that easy!

My LP-10 low cost, no switch light pen is active at all times.

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For my ☐ Commodore 20/64 ☐ Atari 400/800 ☐ Apple II

Enclosed my check for $_____ (allow 3 weeks)
Bill my ☐ VISA ☐ Master Card

Number _____ Expires / /
Signature _____
Name _____
Address _____
City _____ State _____ Zip _____

30 day money back guarantee PC-8

IF YOU'RE CONFUSED ABOUT BUYING A PERSONAL COMPUTER, HERE'S SOME HELP.

Computers come in two parts.

One part is the "hardware," the machinery itself. The other is the "software," which tells a computer what to do, the way a driver tells a car what to do.

Without software, a computer can't do anything. And vice versa. You have to buy both.

Buy the software first.

Since the reason you're buying a computer is to get the capability the software gives you (remember it's the software that tells the computer what to do), it makes good sense to pick the software first.

Start by making a list of the things you want the computer to do. Possibilities include word processing, inventory control, accounting, graphics, recordkeeping—you name it, there's probably software that does it.

Next take your list into a computer store and ask the salesperson to demonstrate software that will do the things you want.

Even though you'll need a computer for the demonstration, keep in mind the computer is just a vehicle. The software is the driver. Once you've decided on software, picking the rest of the computer system will be that much easier.

The simpler the better.

Some people will tell you that software has to be complicated to be powerful. Nothing could be further from the truth.

Good personal software should be, as the computer people say, "friendly." Meaning that it helps you do what you want to do without getting in the way.

Good software keeps the complications in the computer, where they belong. And keeps the capability at your fingertips. It's that simple.

Simply see for yourself.

You can read any number of interesting books and magazines about personal computers. You can ask your friends who have them.

Or look at all the sales literature you can get your hands on.

But as helpful as that can be, there's no substitute for a live demonstration.

When you do go shopping, we recommend you take a look at the PFS® Family of Software.

Designed the way we think a software family should be: simple, straightforward and powerful.

Currently there are four software packages in the family: PFS:WRITE, PFS:FILE, PFS:REPORT and PFS: GRAPH, with more on the way. Here's a little more about each of them.

PFS:WRITE. The simplest way to get your message across.

PFS:WRITE is ideal for people who want to make their writing time more productive. It displays what you write on your computer screen so you can make revisions as you compose.

With WRITE, you can correct misspellings or substitute one portion of text for another, with just a few keystrokes.

And when you're through revising, WRITE shows you "on-screen" just how your document will look when it's printed. So there are no surprises afterwards.

WRITE also works with most popular software programs, including the PFS Family of Software.

This feature allows you to add names and addresses from mailing lists to generate form letters. Or combine columns of numbers or graphs with your text.

PFS:FILE. The simplest way to get organized.

FILE is basically a paper filing system without the paper. So you can record, file, retrieve and review information in a fraction of the time it takes with a conventional filing system.

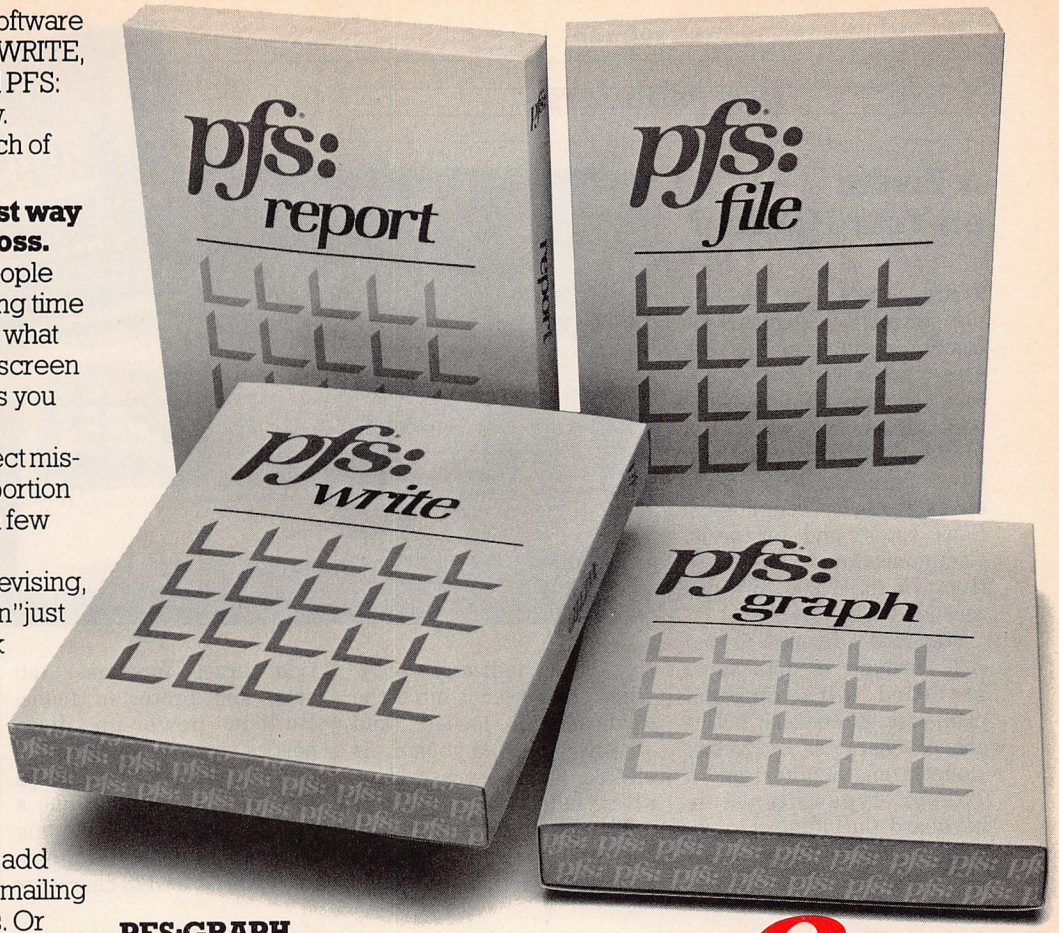
With FILE, you arrange your information on a "form" you design yourself. And when you need to track something down, FILE sorts through your records electronically. It lets you retrieve information in a variety of ways so you can be as selective as you want.

PFS:REPORT. The simplest way to sum it all up.

REPORT is a powerful analysis tool that works with FILE.

REPORT sorts through your files and retrieves the information you're looking for. Then assembles it all into one report, so you can analyze, plan and make better-informed decisions.

REPORT is also good at math. It quickly sorts through columns of numbers and performs calculations, so you won't have to.



PFS:GRAPH. The simplest way to spot trends.

GRAPH is ideally suited for professionals who need charts or graphs in a hurry.

All you do is specify the kind of graph or chart you want and enter the information. GRAPH does the rest.

GRAPH transforms columns of facts and figures into pie, line and bar charts so you can spot trends quickly and make better-informed decisions.

GRAPH works with PFS: WRITE, PFS:FILE, VisiCalc® files or data entered directly into the computer. And supports most popular printers and plotters.

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Circle 98 on inquiry card.

A Zenith on Your Horizon?

Zenith's Z-29 terminal, designed with the novice in mind.

Zenith's Z-29 is an easy-to-use terminal designed for computer novices. Its on-screen menu lets you set system configurations easily and efficiently, while the user-defined settings let you alter parameters such as even/odd parity, communications rates, and protocols. Communications rates range from 75 to 19,200 bits per second.

Standard features of the Z-29 include a detachable keyboard with optional palm-rest extensions; a tiltable 80-character by 25-line monochrome monitor; and a 77-key, typewriter-style keyboard (including a separate 14-key numeric keypad). Four LED (light-emitting diode) indicators show when the power is on, if the keyboard is locked, and whether the keyboard is shifted for uppercase characters only.

The Z-29's on-screen editing options include character or line insertion and deletion, erase functions, tab sets, and protected fields. Built-in power-up diagnostics ensure proper operation and pinpoint failures on screen. The terminal has a 256-character set, including 33 graphics characters, plus an alternate 128-character set that incorporates subscripts, superscripts, and special symbols and shapes. The Z-29 retails for $849.

More information is available from Zenith Data Systems, 1000 Milwaukee Ave., Glenview, IL 60025.

Circle 213 on inquiry card.

Professional Joystick

Coin Controls has unveiled its Competition-Pro joystick for home computers. Patterned after the controls used in arcade games, the Competition-Pro joystick offers players good response and high precision.

Priced at $24.95, the joystick features dual fire buttons for use by both right- and left-handed players. An eight-direction, nylon-covered steel knob and shaft ensures rapid and accurate control. The Competition-Pro joystick can be used with Atari, Commodore, and a variety of other computer systems and game consoles. For details, write Coin Controls Inc., 2609 Greenleaf Ave., Elk Grove, IL 60007.

Circle 214 on inquiry card.

Drawing on the HP Graphics Tablet

Hewlett-Packard's HP 17623A interactive graphics tablet lets users easily create a wide variety of high-resolution graphics on the HP 2627A color-graphics terminal.

Retailing for $1920, the tablet uses a penlike stylus to develop graphics for business and scientific applications such as parts design, surveying, sales analysis, and overhead slide presentations. Because digitizing pens often slip from the pressure of depressing the pen switch, the HP 17623A includes special keys on both the stylus and tablet that eliminate the need to apply pressure. To make data entry easier for both right- and left-handed operators, another button on the tablet rotates the HP 17623A's coordinate system to the appropriate positions.

For more information, contact Inquiries Manager, Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303. □

Circle 215 on inquiry card.

Circle 103 on inquiry card.

Don't let price get in the way of owning a quality printer.

Adding a printer to your computer makes sense. But deciding which printer to add can be tricky. Do you settle for a printer with limited functions and an inexpensive price tag or buy a more versatile printer that costs more than your computer? Neither choice makes sense.

Here's a refreshing option—the new, compact STX-80 printer from Star Micronics. It's the under $200 printer that's whisper-quiet, prints 60 cps and is ready to run with most popular personal computers.

The STX-80 has deluxe features you would expect in higher priced models. It prints a full 80 columns of crisp, attractive characters with true descenders, foreign language characters and special symbols. It offers both finely detailed dot-addressable graphics and block graphics.

And, of course, the STX-80 comes with Star Micronics' 180 day warranty (90 days on the print element).

The STX-80 thermal printer from Star Micronics. It combines high performance with a very low price. So now, there is nothing in the way of owning a quality printer.

*Manufacturer's suggested retail price.

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THE POWER BEHIND THE PRINTED WORD.

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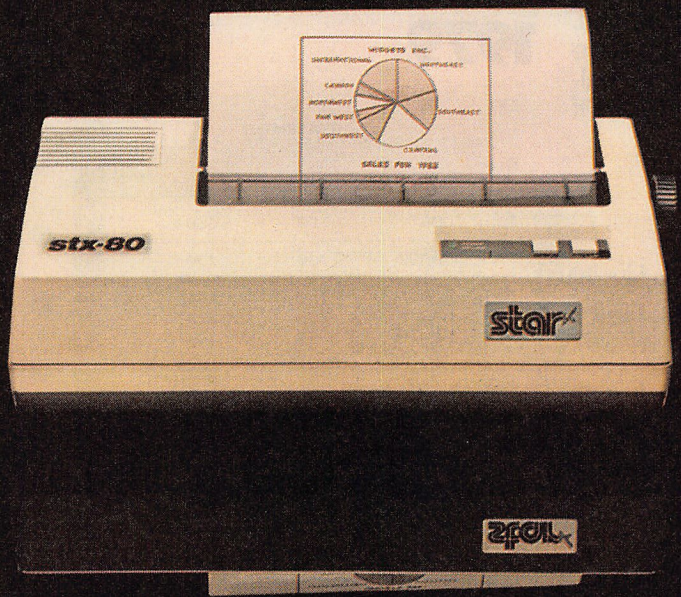


The new STX-80 printer for only $199.*

It took hundreds of years to build the world's most advanced spreadsheet.

Way back in 1534, a Venetian scholar wrote a text that standardized the techniques of modern bookkeeping. And up till 1979, there weren't a lot of real improvements in the way people did spreadsheets. You still had to enter all your figures by hand. Run all the totals yourself. And when you had to make a few changes, you had to run the totals all over again.

Then along came a program that let you create spreadsheets on a personal computer. Without touching a pencil. Or adding anything by hand. Best of all, this new program gave you the freedom to look at your balance sheet a dozen different ways if you felt like it. Because all you had to do was change one figure, and the computer would refigure everything else for you. Automatically.

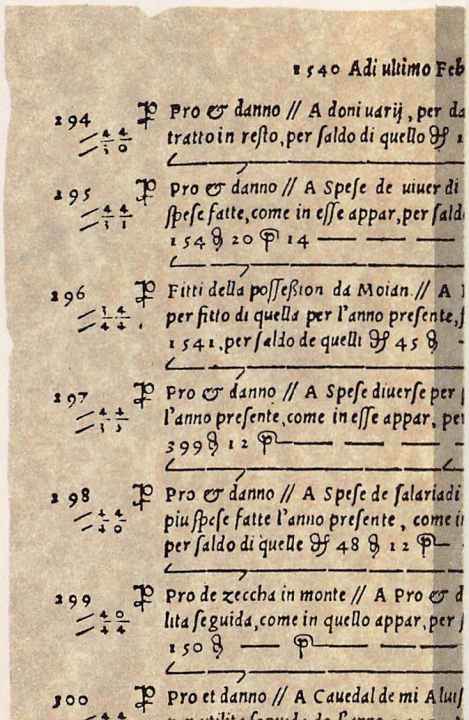
Like most breakthrough ideas though, this original spreadsheet program had a few things that definitely needed improvement. For instance, all the columns had to be the same width. And the entire system took about 20 hours to learn.

So we developed SuperCalc,® which was such a giant step in the right direction that it became a best-seller. Over 250,000 copies in only 18 months.

Today, we've gone even farther. After talking with thousands of customers, we've found a lot of important new features you'd like to have. And we've built them into the world's most advanced spreadsheet.

SuperCalc².

1534



1979

STATEMENT

	JAN	FEB	MAR
SALES	1000	1100	121
COST	300	330	363
GROSS	700	770	847
R & D	160	176	194
MARKETING	200	224	251
ADMIN.	140	151	163
TOTAL	500	551	608
INCOME	200	219	239
TAXES	80	88	96
NET	120	131	143

1981

INCOME STATEMENT

NET SALES
COST OF GOODS SOLD
GROSS PROFIT
RESEARCH & DEVELOPMENT
MARKETING
ADMINISTRATIVE
TOTAL OPERATING EXPENSES
INCOME BEFORE TAXES
INCOME TAXES
NET INCOME

It'll take you 10 minutes to learn it.

10 minutes to SuperCalc².

Create your first spreadsheet model in 10 minutes flat.

With SuperCalc², you get all kinds of features that have never been possible before. Like custom formatting capabilities. Automatic consolidation. Sorting. And more. Take a look at the spreadsheet below, and you'll see just how much we're giving you.

Best of all, we made it just as easy to use as the original SuperCalc. There's a self-paced starter guide that shows you exactly what to do, step by step. And an AnswerKey™ that gives you instant help right on the screen. Because of these features, you can actually create your first spreadsheet in 10 minutes flat. Even if you've never used a computer before.

SuperCalc² is available for the IBM PC and XT. Where it can run in full color. With full memory. Even on hard disk. It's also available for CP/M, CP/M-86, MS DOS and other operating systems, so you can use it with most popular personal computers.

But with all its advanced features, SuperCalc² is the same price as the original SuperCalc. Only $295, suggested retail. We're also offering SuperCalc for only $195. And an upgrade to SuperCalc² whenever you're ready.

So. If you've always thought there had to be a better way to do your spreadsheets, stop by your closest computer store. And take a good look at SuperCalc². After just 10 minutes, you won't want to do one more spreadsheet the old way.

1983

Combines any number of spreadsheets —automatically!

Calendar/date capabilities.

Percentages.

User-set decimal places.

Floating $ signs.

Embedded commas.

Negative numbers in ( ).

Arrange reports numerically or alphabetically, like this

Numbers in 100s or 1000s.

COMPANY CONSOLIDATED MONTHLY PAYROLL

Today's Date			4/15/83		Deduction Percentages	
Payroll Start Date			4/ 1/83		Fica	6.700%
Days this period			15		SDI	.8%
Recalculate YTD Y/N ?	N					
Emp#	Employee name	Status	Gross Salary	Total Deduct	Net Pay	YTD Gross
34	Adams	M	$1,100.00	($82.50)	$1,017.50	$6,200.00
49	Beckette	S	$750.00	($56.25)	$693.75	$5,250.00
84	Johnson	S	$850.00	($63.75)	$786.25	$5,950.00
92	Jones	M	$900.00	($67.50)	$832.50	$6,300.00
12	Samson	S	$560.00	($42.00)	$518.00	$3,920.00
19	Santos	M	$650.00	($48.75)	$601.25	$4,550.00
45	Smith	S	$700.00	($52.50)	$647.50	$4,900.00
Total # employees		7				
Total Gross Salaries (100's)			$55.1			
Total Deductions (100's)			$-4.1			
Total Net Pay (100's)			$51.0			

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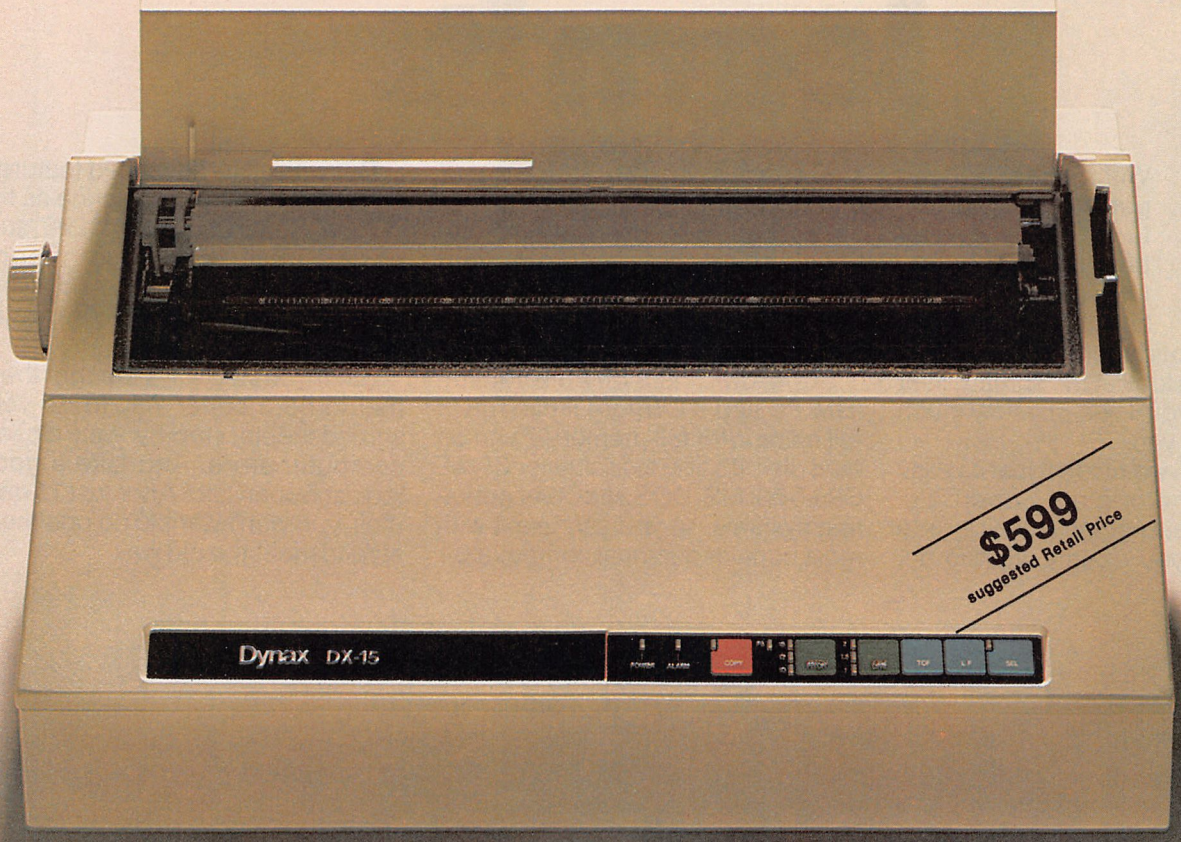
DYNAMITE



The Dynax DX-15 explodes into the eighties as the most advanced letter-quality printer on the market today. Complete with all the sophisticated features found in your costlier models, and offering such options as Key Board, Tractor Feed, and Auto Cut Sheet Feed, the DX-15 assures the user, whether it be for business, home or word processing applications, the ultimate in reliability and durability at a blow-away price.

The DX-15 won't blow your budget either, but it will blow the myth that a printer with all these advanced features has to be expensive. Visit or call your nearest dealer for full particulars and let us blow your mind at how inexpensive it is to put you behind the printer of the eighties, **the Dynax DX-15... It's Dynamite.**

Dynax

DYNAX INC. 5698 Bandini Blvd., Bell, CA 90201

Business

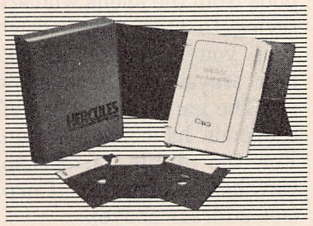
ASP—A business package that combines the functions of a word processor, a database manager, and a mailing-list program. ASP lets you define up to 10 fields per record; each field has its own label and designated length. Other features include a capacity of more than 2000 records and two different printing formats. For the **Apple III** with 256K bytes of memory; $99.95. Plain and Simple Software, 9003 Lexington NE, Albuquerque, NM 87112.

Business Planner—A program that gives you a model of your business based on monthly income and expenses, budget allocations, and sales forecasts. This package will provide the solutions to "what-if" questions in order to save you time and money. For the **Apple II** and **IBM Personal Computer**; $295 and $395, respectively. Duosoft Corp., 1803 Woodfield Dr., Savoy, IL 61874.

Doctor's Billing System—A medical program designed to record and retrieve patient records. This system can handle more than 15,000 accounts and will automatically process patients' statements, third-party bills, recall notices, delinquent account letters, and transaction histories. For **CP/M-based** systems with 64K bytes of memory and a hard-disk drive; $1200. Data Resolution Inc., 1817 Acushnet Ave., New Bedford, MA 02746.

EZEntry—An order-entry and invoicing program featuring automatic extension and sales taxes, storage for up to 200 product codes and prices, and up to 500 orders per single-sided disk. It can produce customized invoices and reports. For the **IBM Personal Computer**; $99.95. Systemics, 3050 Spring St., West Bloomfield, MI 48033.

Hercules—A program for trucking companies that tracks and compares the costs of fuel, oil, and repairs for five or more vehicles. Hercules lets you develop maintenance schedules and provides a variety of comparison and management reports. For the **IBM Personal Computer**; $1995. Computer Task Group Inc., 800 Delaware Ave., Buffalo, NY 14209.



Integrated General Accounting Systems—A business package containing six individual modules: general ledger, accounts receivable, accounts payable, order entry with billing, inventory control, and sales analysis. These menu-driven programs are written in Pascal MT+ and allow you to change file definitions and screen and report formats without changing related programs. For **CP/M-80-** and **CP/M-86-based** systems; $950 per module. Small Business Systems Inc., 1016 East 31st St., La Grange Park, IL 60525.

Participative Management Skills—A set of tutorial lessons designed to improve communications between employees and management and increase productivity. For the **IBM Personal Computer**, **Apple II**, and the Radio Shack **TRS-80 Models II, 12,** and **16**; $249.50. Duosoft Corp. (see address above).

Sunmail I—A mailing-list maintenance program with files that include contact name, business name, address, foreign address, nine-digit zip codes, two phone numbers, and two dates. This menu-driven program also allows unlimited codes for identifying special features about each name and address record. For the **IBM Personal Computer** with 64K bytes of memory; $199. Documentation manual and demonstration disk are also available; $25 and $10, respectively. Sunward Systems Inc., 655 West Irving Park Rd. #5203, Chicago, IL 60613.

Tallymaster—A financial program designed for people in charge of budgets and sales. Some 700 categories, which can also be grouped and totaled into higher categories, are provided for revenues and expenses. Other features include a help command, four-way sorting, file merging, multicolumn printed reports, and simple sales projections. For the Radio Shack **TRS-80 Models I** and **III**; $79.95. Prosoft, POB 560, North Hollywood, CA 91603.

The Tax Mini-Miser—A tax tool for accountants, stockbrokers, investment counselors, lawyers, and people in higher tax brackets. This easy-to-use program lets you test up to six alternative tax strategies for a single year and project how a single strategy will affect your tax refund up to six years later. The program will be updated whenever tax laws change. For the **Apple II, IIe, III,** and the **IBM Personal Computer**; $295. Annual updates; $50 to $75. Sunrise Software, 36 Palm Court, Menlo Park, CA 94025.

Games

Asteroid Field—While trapped in an asteroid field, you must try to find an escape route and, at the same time, fight off attacking alien missiles. For the **Apple II**; $29.95. Cavalier Computer Corp., POB 2032, Del Mar, CA 92014.

Bug Attack—An arcade-type game in which you maneuver your beetle around your garden in an effort to stop the ants, millipedes, and medflies that are trying to destroy the plant life. This game features colorful animation, music, and sound effects. For the **Apple II** and **Atari 400/800** with 24K bytes of memory; $29.95. Cavalier Computer Corp. (see address above).

The Dark Crystal—An adventure game based on

New Software provides up-to-date listings of the latest releases in microcomputer software, grouped into seven categories: Business, Games, Home, Education, Programming Languages, Word Processing, and Technical Tools. New Software listings are based on product information supplied by the manufacturers and should not be considered endorsements of the products listed. For in-depth evaluations of the most important and interesting new releases, read our Software Review section.

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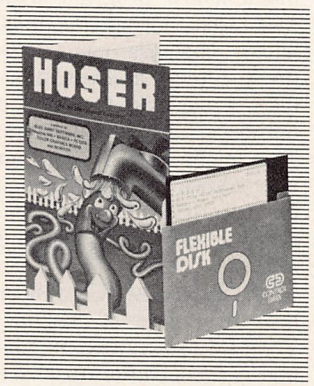
the movie *The Dark Crystal*. In the role of Jen, last of the Gelfling race, you must find a shard of the great crystal and restore it before the Great Conjunction. Failure to do so will mean that the evil Skeksis will rule the world forever. For the **Apple II** and **II Plus** with 48K bytes of memory; $39.95. Sierra On-Line Inc., Sierra On-Line Building, Coarsegold, CA 93614.

Flip-Ello—A computerized version of the board game Othello. Flip-Ello is played by the same rules as Othello, but the computer automatically flips all the pieces and keeps score. You can play with another player or against the computer. For the **IBM Personal Computer**; cassette requires 16K bytes of memory; disk requires 48K bytes of memory, $12.50. Resuba Digital Systems, Department 6, POB 440, Blackwood, NJ 08012.

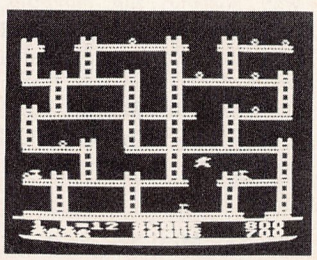
Gypsy—An arcade-type game in which you play the part of a gypsy moth caterpillar trying to devour a Qok tree. Each bite you take increases your score, but you must avoid such creatures as the Locknest Spider and the Fandango Bee. Requires a joystick. For the **Atari 400/800**; disk requires 32K bytes of memory, $26; cassette requires 16K bytes of memory, $21. Microcomputer Games, 4517 Harford Rd., Baltimore, MD 21214.

Hide and Sink—A strategy game that takes place on the high seas. Equipped with a fleet, you play against the computer and try to sink as many of the opponent's ships as possible. Hits and misses are recorded as well as the status of both fleets. Three variations are provided. For the **Apple II** with 48K bytes of memory and a color monitor; $34.95. Mirror Images Software, 1223 Peoples Ave., Troy, NY 12180.

Hoser—A full-color graphics game. Try to control the hose that appears on the screen by maneuvering it around the colored obstacles. There are 15 screens for the novice and 15 for the expert. Requires color graphics board, monitor, and a minimum of 64K bytes of memory. For the **IBM Personal Computer**; $29.95. PC Connection, Mill St., Marlow, NH 03456.



Jumpman—A science fiction arcade-type game. Aliens have planted bombs on all 30 levels of the Jupiter headquarters. Your mission is to find and defuse the bombs before they explode. Jumpman features music, sound effects, and colorful graphics. For the **Atari 400/800** with 32K bytes of memory; $39.95. Epyx/Automated Simulations, 1043 Kiel Court, Sunnyvale, CA 94086.



Marauder—An arcade-type game. With the help of three spaceships, you must fight and destroy the defense system of an alien planet. If you are successful in your mission, you land your ship in the city's ruins and set out to demolish the planet's power source while avoiding the homicidal robots. For the **Atari 400/800**; $34.95. Sierra On-Line Inc. (see address above).

Star Crystals—An arcade-type game. Scientists have discovered crystals hidden beneath the surface of the planet Croga that can capture and amplify solar energy for Earth. To retrieve the crystals, you must first overcome the intricate defense system above and below the planet's surface. For the **Atari 400/800**; cassette requires 16K bytes of memory; disk requires 24K bytes of memory; $29.95. Program Design Inc., 95 East Putnam Ave., Greenwich, CT 06830.

Starthief—An arcade-type game that puts you in the role of a federal security marshal. Your mission is to protect the federation fuel pods from the aliens who are trying to steal them. Each time you defeat an attack, new waves of aliens show up. The game ends when all the pods have been stolen. For the **Apple II**; $29.95. Cavalier Computer Corp. (see address above).

Education

BASIC Tutor—A system that helps you learn how to program in BASIC. This program uses graphic illustrations and lesson summaries. No previous knowledge of programming is required. For the **Apple II Plus, IIe,** and the **IBM Personal Computer**; $99. Supersoft, 1713 South Neil St., POB 1628, Champaign, IL 61820.

Cus/Staff—A program for school officials that uses an individualized formula to determine the number of custodians needed for a college, school, or for an entire school district. Based on information you provide, the program will also project future needs due to changes in the system. For the **Apple II, II Plus,** and **IIe**; $245. Masbo Cooperative Corp., 99 School St., Weston, MA 02193.

The IBM Personal Computer Primer Series—A package of six computer-aided instruction modules that teach you the functions, features, and operation of the **IBM Personal Computer**. The series covers basic terminology and concepts related to data processing and how to develop a short BASIC program, load the disk operating system, and copy disks. For the **IBM Personal Computer**; $150 per course module. Computer Systems Research Inc., 195 West Main St., POB 45, Avon, CT 06001.

Millionwaire—An educational game set in the style of a television quiz show. The players bet brain bucks on their ability to answer questions at various levels of difficulty. The object of the game is to win $1 million. Forty-one subject categories to choose from. For ages 8 and older. For the **Apple II Plus** with 48K bytes of memory; $49.95. Brainbank Inc., 220 Fifth Ave., New York, NY 10001.

Pipes—An educational game that teaches you how to budget your money and carry out a project. As a plumber, your job is to connect a pipeline from the water-supply tank to every house shown on the screen using as little pipe as possible. Both your budget and pipe supply are limited. To win the game, you must construct the pipeline so that there are no leaks. For the **Commodore VIC-20**; car-

tridge, $39.95. Creative Software, 201 San Antonio Circle, Mountain View, CA 94040.

Spy vs Spy—A word game in which you try to guess the secret word in order to gain access into an embassy. Each player has 12 chances to guess the word; if none of the players guess the word, the computer will reveal it. For the **Atari 400/800**; cassette version requires 16K bytes of memory, $18.95; disk version requires 32K bytes of memory, $23.95. Program Design Inc., 95 East Putnam Ave., Greenwhich, CT 06830.

Tycoon—A commodity market simulation that teaches the player how to engage in the trading of such commodities as gold, soybeans, Treasury bills, foreign currency, pork bellies, and more. A built-in program generator is included to allow you to create your own scenarios. For the **IBM Personal Computer**, $99.95. Blue Chip Software, Suite 125, 19824 Ventura Blvd., Woodland Hills, CA 91364.

Vocabulary Building Games—A series of four games that increase vocabulary, logic, and problem-solving skills. The games are Astroquotes, Kross 'N Quotes, Minicrossword, and Time Bomb. For the **Atari 400/800**; complete set, $59.95; individual cassettes, $16.95; individual disks, $23.95. Program Design Inc. (see address above).

Wordzzp—A spelling and vocabulary-building game that includes a 500-word, user-changeable dictionary. Wordzzp is a variation of the classic hangman game in which a word is chosen and the players try to guess it in as few turns as possible. For the **Atari 800** with 40K bytes of memory and joystick; $18.95. Generic Software, POB 27463, Minneapolis, MN 55427.

Home

Coins—A program for coin collectors that helps record data and produce reports for personal investment and tax purposes. Coins features information and market prices on 1600 of the most common American coins in all grades. This data is updated and distributed on a quarterly basis. The program may also be used to keep track of nonstandard coins. For the **IBM Personal Computer** and the Radio Shack **TRS-80 Models I** and **III** with 64K bytes of memory and a printer; $95. Quarterly updates are available for $25 each. CompuQuote, 6914 Berquist Ave., Canoga Park, CA 91307.

Deluxe Personal Finance—An expense-oriented financial-analysis program that can be tailored to your financial situation. The system features the ability to support up to 900 check transactions per year; separate payment made by cash or check; search, correct or void checks; maintain an accurate checking-account balance; and estimate monthly expenses. For the Radio Shack **TRS-80 Model II**; $79.95. Rizzo Data Systems Corp., 33 Westwood Ave., POB 458, Bridgeton, NJ 08302.

Family Roots—A geneology-research package comprised of six programs; edit, search, text, charts, sheets, and lists. This easy-to-use system can be adapted to suit your specifications. The utilities included allow you to generate address lists, renumber person IDs, and print blank charts. For the **Apple II Plus, IIe,** and **IBM Personal Computer**; $185. Quinsept Inc., POB 216, Lexington, MA 02173.

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Health-Aide—A diet-analysis and nutrition program for personal or professional use. This program features 21 nutritionally balanced menus, 32 nutrient values for more than 800 foods, daily and monthly analyses of food intake, and recipes. For the **Apple II** and **III** with 48K bytes of memory; $79.95. Knossos Inc., 422 Redwood Ave., Corte Madera, CA 94925.

Music Maker—A program that lets you compose and play music on your **Apple** without additional hardware. The tutorial section of the documentation provides the guidance you need to input almost any musical note. The program will produce voice melodies, chords, sound effects, and different tempos. For the **Apple II** with 48K bytes of memory; $39.95. Sublogic Corp., 713 Edgebrook Dr., Champaign, IL 61820.

Sapana Household Track I—A personal-inventory program that tracks and maintains a file of household items for insurance purposes. This system can store more than 2000 items on a single-sided disk and almost 5000 items on a double-sided disk. Requires 64K bytes of memory, PC-DOS, 80-column display, and printer. For the **IBM Personal Computer**; $49.95. Sapana Micro Software, 1305 South Rouse, Pittsburg, KS 66762.

Word Processing

Magic Spell—A proofreading program that automatically highlights misspelled words. This menu-driven program has a 20,000-word dictionary that can be expanded to include frequently used words. Hyphens, apostrophes, and punctuation are all recognized. For the Zenith **Z-90** and **Z-100** computers; $295. Zenith Data Systems, 1000 Milwaukee Ave., Glenview, IL 60025.

Newscript—A word-processing program that supports most popular printers and includes such features as flexible page layouts, customized form letters, and the ability to generate a table of contents, index, or legal form. For the Radio Shack **TRS-80 Models I** and **III**; $124.95. Prosoft, POB 560, North Hollywood, CA 91603.

Ted—A text-editor and file-management program. This easy-to-use, menu-driven program provides tutorial help files for hands-on instructions. Ted will merge and transfer files between disks, perform single-keystroke DOS commands, and allow 80-column editing without additional hardware. For the **Apple II Plus** with 48K bytes of memory; $49.95. Humans, POB 644, Falls Church, VA 22046.

Vedit 1.37—An updated version of the Vedit text editor. New features include a disk-directory display, ten text buffers, command macroinstructions that can be saved and loaded from disk, and automatic search and replace. For **CP/M-, MP/M-, CP/M-86-,** and **MS-DOS-based** systems, the **IBM Personal Computer,** and **Z80-based** systems; prices range from $150 to $195 depending on the system. Compuview Products Inc., Suite 200, 1955 Pauline Blvd., Ann Arbor, MI 48103.

Wordcraft 20—A high-level word processor designed for easy implementation and professional results. Wordcraft 20 provides a ruler scale across the top of the screen, automatic centering, addition, insertion, and merging of text, status display, and more. For the **Commodore VIC-20**; $270. United Microware Industries Inc., Suite C, 3503 Temple Ave., Pomona, CA 91768.

Languages

The Assembler—An assembly language for beginning programmers. The Assembler features global editing and search and replace functions and provides step-by-step instructions for using the program. Its companion program, Macrosoft, lets you write BASIC programs that run at machine-language speeds. For the **Apple II, II Plus,** and **IIe**, $69.95; with Macrosoft, $99.95. Micro-Sparc Inc., POB 325, Lincoln, MA 01773.

Technical Tools

BASIC Aid—An enhancement program for the Radio Shack **TRS-80 Color Computer**. Features include automatic line numbering and single-key entry for most commands. A merge command allows BASIC routines to be stored on cassette and merged with the program in memory. For the Radio Shack **TRS-80 Color Computer**; $35.95. Spectrum Projects, 93-15 86th Dr., Woodhaven, NY 11421.

The Creator—A menu-driven program that helps you design a variety of application programs without any previous programming knowledge. The programs you design can be tailored to meet your needs and offer you the option to modify them at any time. For the **IBM Personal Computer**; $300. Software Technology for Computers, 430A Main St., Watertown, MA 02172.

The Graphic Solution—An animation- and graphics-creation program designed for the nonprogrammer. The Graphic Solution allows single-keystroke editing, dual low-resolution and high-resolution operation, and gives you the ability to combine animated text and graphics on the screen. For the **Apple II** and **III**; $149.95. Demonstration disk, $10. Accent Software Inc., 3750 Wright Place, Palo Alto, CA 94306.

Super Cataloger—A multi-disk catalog program that helps you determine the location of any program or find the amount of memory remaining on any disk. It maintains up to 550 file names for up to 63 disks. For the Texas Instruments **TI-99/4A**; $19.95. J & K H Software, 2820 South Abingdon St., Arlington, VA 22206.

V-Spool—A print buffer that lets you maintain complete control over your computer while sending information to the printer. It buffers in memory up to 16K bytes of text being sent to the printer, which frees the computer for other uses. For **CP/M-based** systems; $79. Compuview Products Inc., Suite 200, 1955 Pauline Blvd., Ann Arbor, MI 48103.

Xchange-11—A file-transfer communications package that lets you send and receive information between an **Apple II** and a **Digital Equipment Corporation PDP-11 RSTS/E** system; $995. George W. Hallahan and Co., 1660 Soldiers Field Rd., Boston, MA 02135.

Zed—A text editor for program source code and data files that lets you execute standard editing tasks quickly and easily using function keys. For the Heath/Zenith **Z-89** and **Z-90** and **H-8/H-17/Z-19**; $35. Zeducomp, POB 68, Stirling, NJ 07980.□

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When to Buy at a Discount

Don't be swayed by alluring markdowns until you gauge the hidden costs

by A. Richard Immel

"Breathes there the man, with soul so dead,
Who never to himself hath said . . .
'You know, I'd buy that computer if I could get a good deal on it.'"

—Sir Walter Scott, "The Lay of the Last Minstrel," with 20th-century update by Sir Richard Immel

When it comes to buying computers, the system isn't fair. Big corporations seldom pay full price; sometimes they get good deals because they buy a lot of units, but other times it's just because they're big. Even a corporation that buys only one or two computers at a time can usually lean on a Computerland dealer to knock off 15 percent or so as a "standard" corporate discount. The dealer obliges because he expects more business from the company, but that doesn't always happen.

Other corporations get volume discounts by cutting out the middleman and buying directly from the manufacturer, but a company has to be really big to make that pay. If you buy 25 Personal Computers from IBM, for example, you'll get only a 10 percent rake-off. You have to buy about 100 units to get what most companies consider a sizable discount (20 percent or more)—not something the Charlie Chaplin guy in the IBM ads is likely to latch onto.

What about the little guy? How does the small businessman who buys one or two machines get *his* discount? Alas, more often than not he doesn't. He gets the raw deal, says a systems manager with one of New York City's biggest accounting firms. "The small business has no leverage with a vendor," he adds. In his view the best the businessman can do is shop around for hardware—that is, compare prices for the same things at different stores—and, with luck, ferret out a promotional discount or a special deal on mail-order software. "That's what the little guy faces. He's in a tough spot, and it's too bad because these machines were made for the little guy."

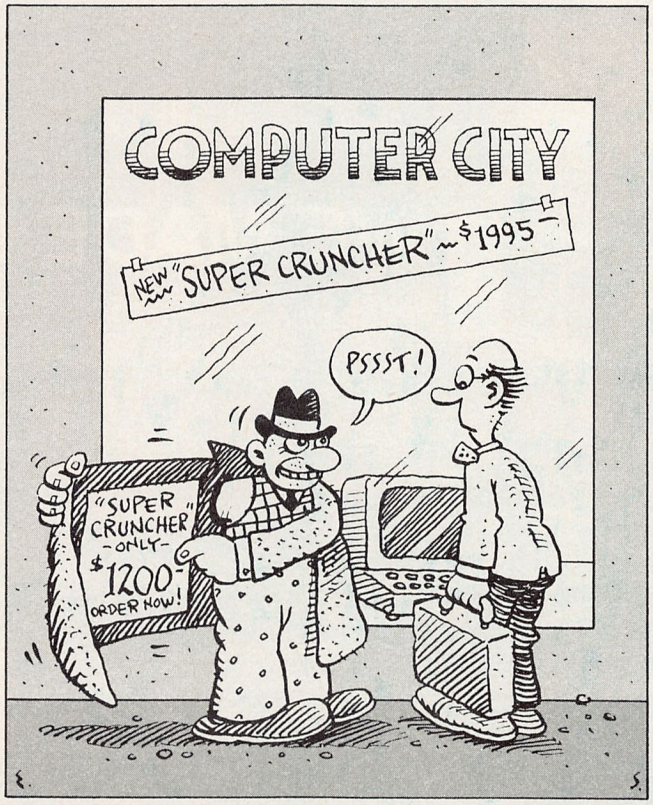

Illustration by Elwood Smith

But wait a minute. Let's say your company's auditing firm has been buying microcomputer systems like a kid buying candy and raking off a 25 percent discount in the bargain. Why not piggyback on the auditor's deals? Maybe ask the firm to put in a good word for you with its vendor or even buy the machines for you? It would work *if* you could find an auditor who would cooperate, but it's not an original idea and it's been known to get people fired. "We're here to audit your books, not sell computers," growls one CPA who neverthe-

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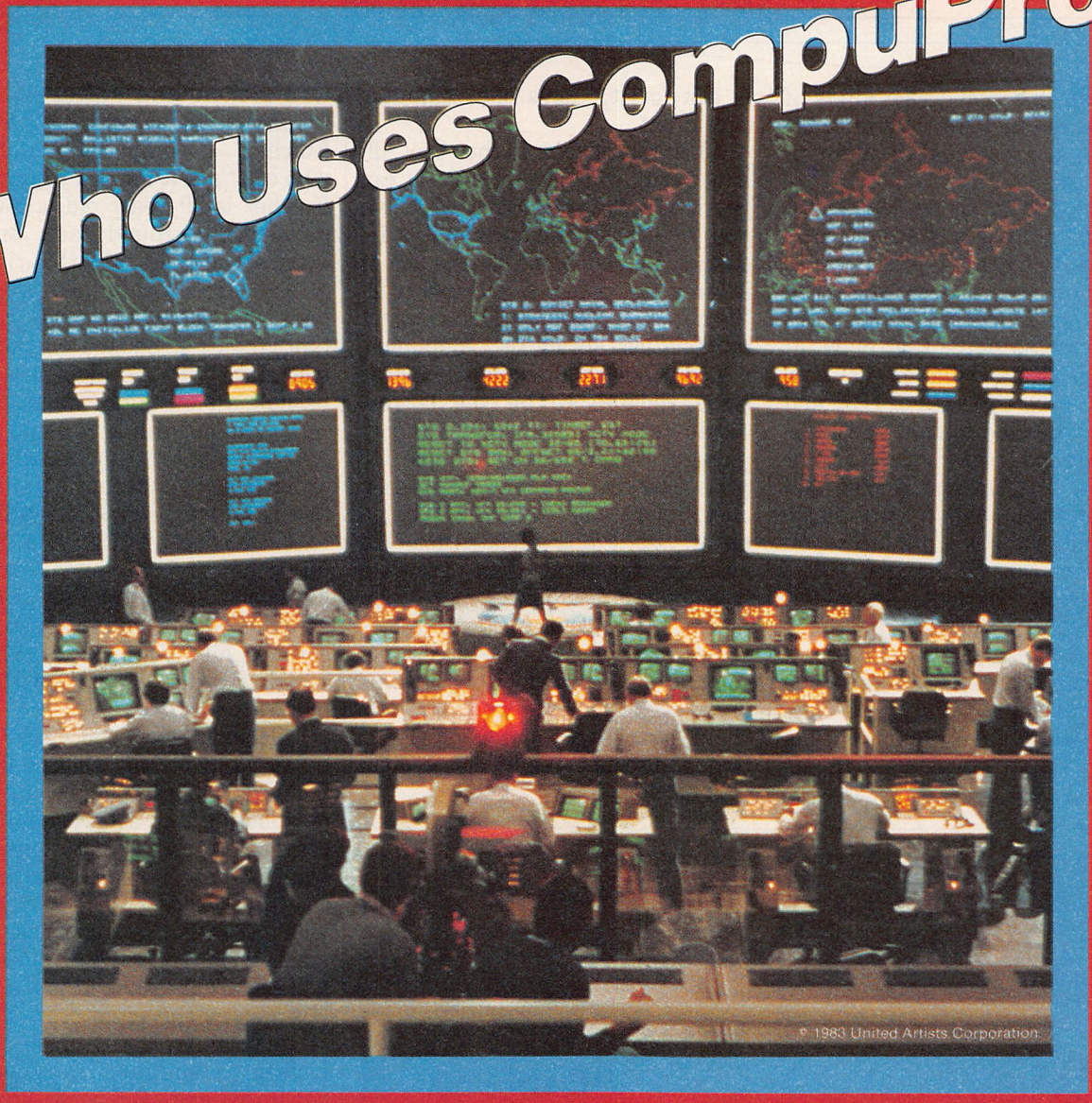
Who Uses CompuPro?



More than 100 highly placed military strategists, one scientist and one very ingenious young computer hobbyist used **CompuPro** systems — in MGM/UA's new film, "War Games."

Two off-stage **CompuPro** systems ran a variety of on-screen computers, creating clever effects programmed by the film's computer consultant, Steve Grumette.

For a gigantic war-room set, Mr. Grumette programmed 120 monitors to flash hundreds of different battle plans at eye-boggling speed — all using just two **CompuPro** systems. He credits **CompuPro's** high operating speed and optional solid state disk drive with making that scene possible. "We couldn't have done it with any other machine because at that time there wasn't any other M-Drive," he said.

Reliability was another reason that Mr. Grumette chose **CompuPro**. As he put it, "When people are busy making a movie, they don't want to wait for somebody to run out and get a printed circuit board fixed."

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less complains that these kinds of would-be entanglements still cause his firm "a great deal of aggravation."

But enough of these dead ends. In truth, getting a discount isn't nearly as tough as it was even as recently as two years ago. The competition in desktop computers has become so fierce that even attempts at Gestapo-like market control tactics by the likes of IBM and Apple have failed to shut down discount and mail-order sales of their products. That means Apples and IBMs—in fact, almost any hardware and software products you can name—can be bought somewhere at a discount. Moreover, with retail computer stores sprouting like dandelions, it's getting easier and easier to get some kind of deal right from your friendly local dealer. "All you have to do is ask for it," says one computer consultant.

What this means is that the All-American whisper—"Psst! I can get it for you wholesale"—is alive and well in the microcomputer industry. Indeed, some signs suggest it may be doing a bit *too* well. Witness the Chapter 11 bankruptcy filing last spring by Compuplus, a Los Angeles discount computer store reputed to be the largest Apple dealer in the world. Compuplus got caught up in an Apple IIe price war in southern California. Just before the store went belly-up, it was selling $1995 Apple IIe systems for less than $1400—a price only a few dollars more than dealer cost. The incident raises some questions for the occasional computer buyer (which most of us are), such as how good a deal should you expect and when is getting a discount really not a good deal at all?

A. Richard Immel is a contributing editor of *Popular Computing*.

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Of Fulchers and Vultures

I had a chat recently with Gary Fulcher, a computer middleman who can "get it for you wholesale." Fulcher is 39 years old, a low-key guy with a round face, smiling eyes, a mustache, and thin-rimmed glasses. He's a reformed programmer who turned computer consultant, then got hooked on the buying part of the business and became a New Age entrepreneur.

Gary is not the kind of guy who offers you the unobtainable in order to sell you what he's got. The fact is he hasn't "got" anything to sell: he doesn't carry a single microchip of inventory. Nor does he want to get your line of credit established. If you want to buy through him, you have to shell out cash in advance. He buys with *your* money, not his.

Fulcher is what you might call a buyer's buyer, and what he does is fairly unusual: he buys computers, peripherals, and software for large companies and institutions who want both an unbiased source and the best price. Fulcher deals in what he calls "commodities." You want 10 microcomputers? Fulcher will call around and get you a price. His piece of the action is 25 percent of what he saves you off list price. Kaiser Aluminum Corporation, Stanford and Harvard universities, and the University of California are some of his customers. He buys for overseas companies too, which is the most lucrative part of his business. He also works for individuals, and in so doing he has become a familiar name to many distributors, distressed dealers, and front companies that make up the supply-side demiworld of the microcomputer market.

Among manufacturers and retailers, "mail-order discounter" is a filthy phrase. If the microcomputer business were rated like movies, mail-order firms would be plastered with a red X. The reasons for this antagonism are partly rational and partly emotional. Manufacturers who dislike mail order say it cheats the buyer

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of the support he needs from his dealer (coincidentally, it also diminishes the manufacturer's power to influence the selling price of products). Computer manufacturers who accept (but don't necessarily approve of) the idea of mail-order sales deal with the support problem by setting up third-party service arrangements (as Televideo Systems Inc. does) or by providing direct factory service (as Corvus does). Retailers hate the mail-order business because they feel its existence turns their stores into "showrooms" for hordes of potential buyers who leave grubby fingerprints all over the equipment in the store, then buy the hardware from a post office box listed in the back pages of computer magazines.

Fulcher looks at the situation a little differently. He sees mail order as a "legitimate market" that appeals to a very limited—but very real—group of buyers. "The majority of buyers want support," he says, "but the mail-order buyer is a unique individual. He is extremely price-conscious, doesn't care about support, and figures he can handle it himself." Fulcher says manufacturers are extremely naive to deny that this demand exists. He doesn't buy the "showroom" argument either. Instead of being a curse on the dealer, it's simply an opportunity for the retailer to convert shoppers into customers by selling what mail order can't deliver: local support and instant availability. And Fulcher thinks of service and support as key determinants of a product's price.

What "List" Should Get You

At the retail level, if you're paying list price or nearly that, the service and support you get should include: unboxing and assembly of the system, testing it to make sure everything works, some rudimentary training (how to use the operating system to format disks and save files, and so forth), and tips on how to connect and maintain your printer. Paying list price offers another big advantage: the right to return to the local store for repairs during the warranty period (usually 90 days from the date of purchase).

The degree of support decreases as the price decreases. The economics go something like this: Most dealers work on a 30–35 percent gross profit margin on the computers they sell. That means on a $5000 system, gross profit runs about $1500 (out of which comes the money earmarked for customer training). One way dealers can cut prices somewhat and retain the same profit margins is to charge for support and training. Some computer stores are now charging a fee for classes in Wordstar, dBASE II, and various spreadsheet programs.

Mail-order discounts generally run from 20 to 27 percent, Fulcher

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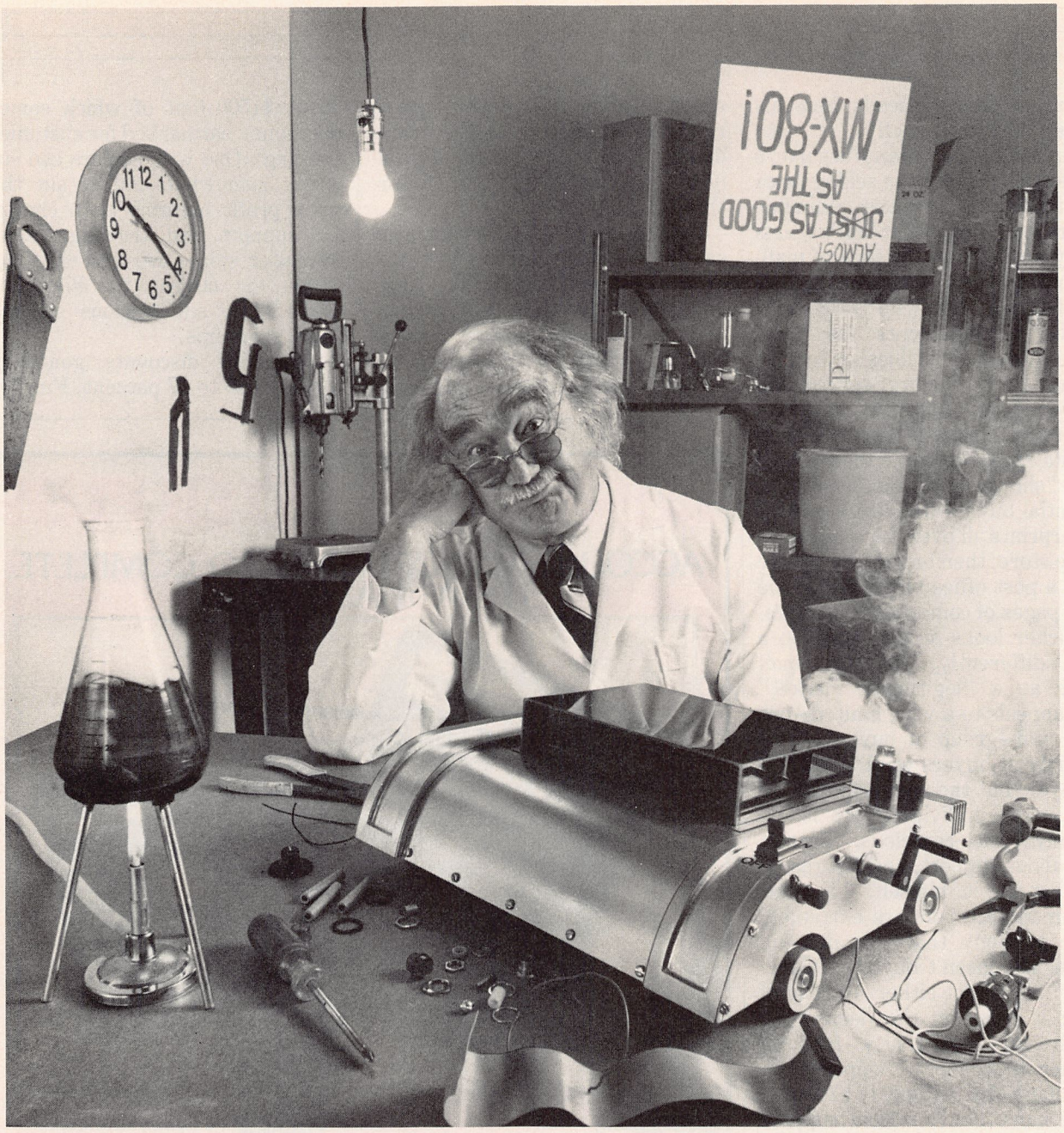

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The Epson MX-80 is the best-selling dot matrix impact printer in the world. It has been since its introduction. And despite the host of imitators it spawned, no one has been able to top it. Until now.

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The new Epson FX-80 is far more than just doo-dads added on to last year's model. It's the most astonishing collection of features ever assembled in a personal printer.

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With a 12K ROM capacity, the FX-80 gives you a few things the others don't. For example, not one, not two, but *seven* different dot addressable graphic modes are program selectable. And can be mixed in the same print line. Everything from 72 DPI (dots-per-inch) Plotter Graphics to the 640 dots per line resolution designed to match the remarkable monitor clarity of the Epson QX-10 personal computer.

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We'd be willing to bet that the FX-80 — like the MX-80 — will have its share of imitators. Don't be fooled. To make sure you get the genuine article, rush down to your local computer store right now and let them show you everything the FX-80 can do.

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says, a level which reflects the narrower profit margins (usually in the 10–12 percent range) that go with reduced or nonexistent customer support. A mail-order discount of less than 15 percent usually won't get much response.

All these figures apply mainly to computers. Peripherals generally have fatter profit margins, while software is in another league altogether: a 50 percent margin for the retailer isn't unusual, Fulcher says, which means the retailer who sells you a word-processing or database-management program receives twice what he paid for it. Is this price too high? Fulcher thinks so. "If you've got a computer up and running and you want to add a second or third copy of software you're already using, you may as well buy it mail order," he advises.

Software merchandising doesn't adhere to the usual price/support equation because in a number of cases support is provided directly by the software manufacturer (Ashton-Tate, which sells dBASE II, is one example). In such a situation it makes little sense to pay full retail price for software unless the dealer offers some overpowering reason, such as "free" classes on how to use a particular software package. On the other hand, you may be better off choosing software that doesn't require special classes or training to make it useful.

Last year Apple Computer got a lot of press for its campaign to shut down mail-order sales of Apples. Less publicized were similar sweeps by IBM earlier this year and by North Star before that. Given this restrictive attitude by certain manufacturers, it would seem that these brands of equipment would be unavailable to the discounter or at least very hard to get. But the Fulchers of this world are not easily thwarted.

Fulcher claims he and any other serious buyer can get virtually anything a customer wants—at a discount, of course. Hmmm. How about one of Apple's new Lisas? "Well, *almost* anything," he hedges. "Sometimes a brand-new product is tight. For a while I won't be able to get it; for a while demand will be so high people can command list or black-market prices." But inevitably demand falls off enough to lower the barriers to open purchase. "IBM Personal Computers were like that," says Fulcher. "It was pretty difficult to get them when they first came out," but not any longer. Once the novelty wears off, it's "Katy, bar the door."

A Bit of Free Advice

Fulcher's two main rules are know what you need and know whom you're buying from. How does the small businessman make the best deal? What *is* the best deal? It depends on your business and your expertise. It can be anything from buying the computer as a commodity—a sealed box at a big discount—to a full-service contract with on-site support.

By all means consider mail order or a no-support discount store if: first, you know exactly what your needs are; second, you don't need help setting up the system; and finally, you know how to get the equipment fixed when it breaks down. Your only concern in this case is repair support.

Whether you're buying discount or not, consider these points in selecting a dealer:

- If you need support and service, can the dealer take care of it?
- Is the dealer well-capitalized?
- Is the dealer making enough profit on the transaction?

Fulcher elaborates on the last point: "The seller has to feel that he made enough money on the deal. I don't agree with the philosophy of chiseling the price down to the penny. If you push too hard you can get the price down to where you want but end up with an adversary who's reluctant to give you support."

Regarding choice of equipment, Fulcher adheres to the "plain vanilla" approach. "It makes more sense to stick with mainstream, standard equipment because it's easier to get service for it and it's easier to sell," he says.

- Buy only the features you really need; technology isn't changing as fast as the vendors would have you believe. Besides, in the office it's the software that makes one computer different from another, not the hardware. With rare exceptions (a Lisa, perhaps, with its unique, integrated approach), there's really not much difference between microcomputers. A box is a box is a box.
- Let someone else be the first on the block with the latest gadget. "I don't think it's ever a smart thing to buy new technologies," Fulcher says. "Let somebody else break them in. Buy something that has a track record."
- Look for deals on bundled software (software that's included with the hardware at no extra charge). That's how dealers can often sweeten a deal without seriously slicing into their overall profit margins.

Before you disregard all these tips and send away for that Supercruncher with the 140K-byte built-in drives and the Isosceles Zwingles at a special introductory 40 percent off, remember that there are times when it's best *not* to wheel and deal. That's why discount hound Gary Fulcher paid the full retail price for his office copy machine.

"I'm in the business. I can get 40 percent off on just about anything I want, but when I needed a copy machine I went downtown and paid list price for it," he confesses. Why did he do such a foolish thing? Because he needs the on-site service and support that comes with full price. "I'm running a $5-million-a-year business with five employees," Fulcher shrugs. "When that machine breaks down, I can't afford to send one of them down to get it fixed." □

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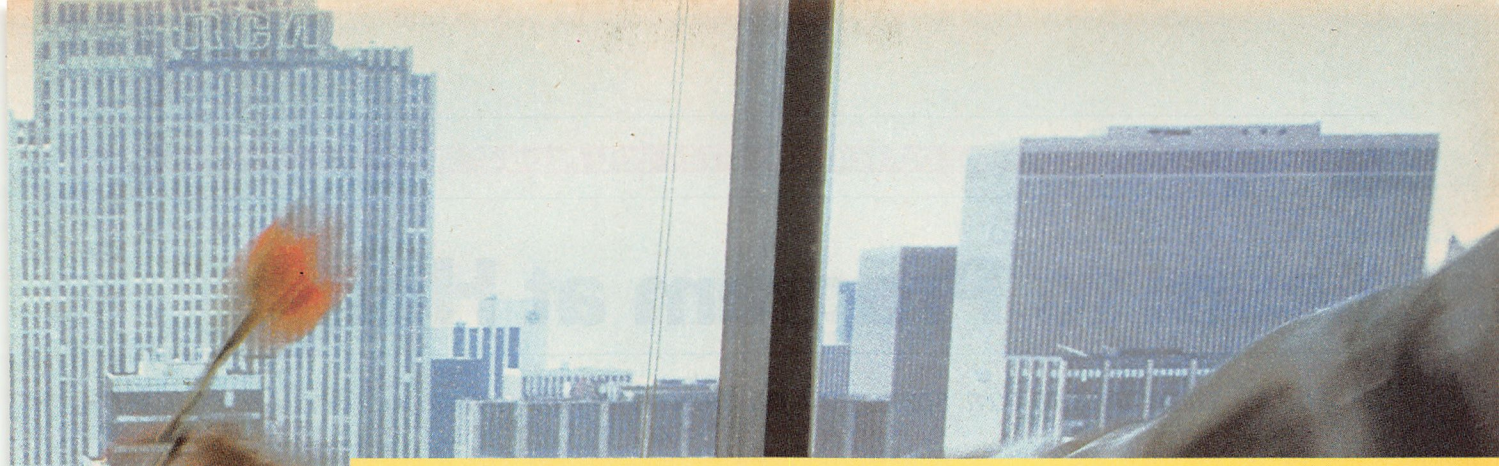

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Learn to Program at Home

A $69.95 investment can start you on your way to a new career. Or can it?

by William Barden Jr.

Learn Computer Programming!" the ad proclaimed. "Learn at Home—Your Own Computer Included with the Course!" I looked over the ad more carefully. Although I fantasized that the advertiser might be giving away an IBM 370 mainframe, the computer turned out to be the somewhat less expensive Timex/Sinclair TS1000 home computer.

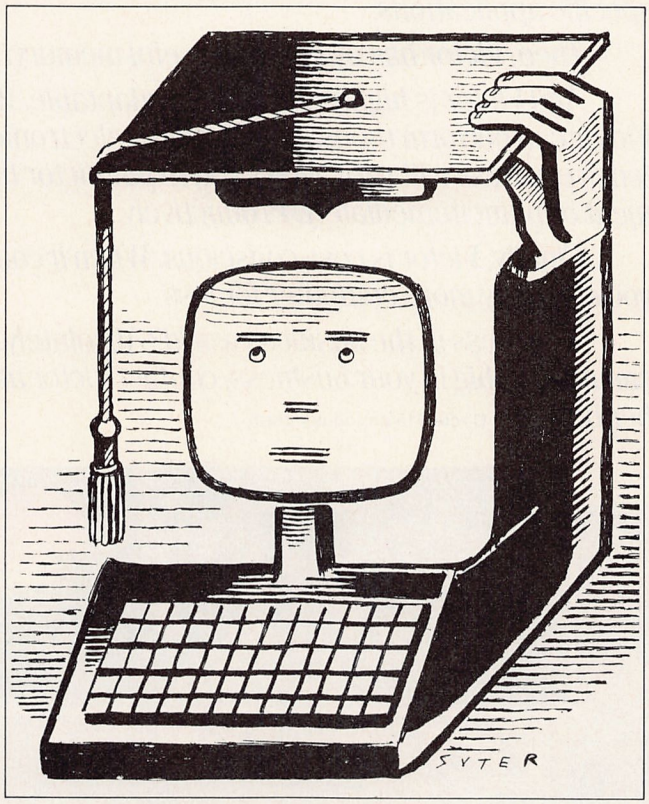
This ad and others like it promise to teach you the fundamentals of computer programming. Many small computers are also sold with this promise spoken or implied. But is it practical to learn computer programming on your own computer? What kind of computer should you buy for that purpose? What about tutorial books and programming classes? We'll try to answer these questions in this column. Just let me get this TS1000 out of the way . . .

Hard Facts About Programming

Let's assume you purchase a small computer that costs anywhere from $69.95 to $5000. Next you invest thousands of hours learning everything there is to know about programming. When all is said and done, can you walk into Digital Equipment Corporation and get a $25,000-a-year job as a computer programmer?

It's possible, but not likely. Consider what a computer science student might have under his belt when he graduates:

- Fifty-four units of general-education courses—political science, history, and so on
- Four semesters of calculus, one semester of probability and statistics, one semester of computer logic, one semester of numerical analysis, and four semesters of other math courses
- One semester of BASIC programming, one semester of assembly-language programming, one semester of other languages, one semester of data structures, one semester of assembler and compiler design, one semester of operating system characteristics, and one semester of automata theory



A computer-science graduate with this impressive background is virtually guaranteed a job as a computer programmer, probably at a starting salary of about $18,000 a year.

Without these academic credentials, you would find it difficult to convince a computer manufacturing firm, university, or large software house that you'd make a good programmer. On the other hand, many commercial programming jobs do not require this background. In fact, knowledge of algebra and a single programming

Illustration by Dave Suter

language is sufficient to program many business applications.

So setting aside lofty ambitions for top-flight jobs in academia and manufacturing, it is indeed possible to learn computer programming at home on your own system and land a job as a programming consultant or salaried programmer. Moreover, your knowledge will certainly be a good foundation should you undertake formal study in computer science later on. Finally, you can learn at least enough to program your own home and business applications.

Before we proceed, however, think about one more qualification—you must have an aptitude for computer programming or computers! I know people in my local users group who still don't know the rudiments of computer programming after years of trying. They've taken courses at high schools, read magazine series, and paid for private tutoring. They've tried books that promise to teach BASIC programming in two days. They've traced existing programs to pick up techniques. But just as I'm mystified by profit-and-loss statements, fuchsias, and piano technique, these people will probably never get the hang of programming.

Are you one of these people? The catch is that you must try to learn about computers before you can say that you don't have the aptitude. Unfortunately, we have no magical profile of a computer programmer.

Which Machine Is Best?

This question is a little like asking, "Which car is best for learning to drive?" You can learn how to drive in a Gogomobile, a Checker, a Cadillac, or a Nissan. However, a few tips might help you decide.

Pick a machine that has "standard" Microsoft BASIC. Every machine is somewhat different, of course, because of optional equipment such as joysticks or disk drives. Many machines, though, use a BASIC interpreter designed by Microsoft Corporation. The BASIC commands in so-called "Microsoft machines" will be similar, if not identical. Program listings in books and magazines are usually written to run on Microsoft BASIC, and knowledge gained on one Microsoft machine will be useful on a different one.

Don't be misled by the cost of a system. You won't be able to learn four times as quickly on a $4000 system as you would on a $1000 system. A VIC-20 or Timex TS1000 is probably just as good a learning tool as an IBM Personal Computer. However, do think about getting a system you can upgrade with disk drives; file-management techniques on disk drives should be an important part of your programming repertoire.

Choose a system that offers languages other than BASIC as options available in disk, cassette, or read-only-memory cartridge form. Languages like COBOL, Pascal, and FORTRAN are all important in commercial programming. We'll be discussing languages later in this column.

Building the Bridge

Humorist Robert Benchley once said he was certain he could build a bridge, if he just knew how to begin. The situation with computers is somewhat similar. Once you've got the system, how do you proceed? Here are my somewhat subjective guidelines.

Learn BASIC first and then learn another language. By far, BASIC is the most commonly used small-computer language. If you're learning about programming so you can program your own system, try BASIC first. If you're learning about programming to start a career, think about adding a second language, but only after you feel competent in BASIC.

For the record, COBOL (Common Business Oriented Language) is an old language widely used in large computer installations for business purposes. FORTRAN is another old language still used in much scientific work. Pascal is a newer language being stressed in most colleges and universities; as a result, it will probably become a widely used language. C is another new language that is used on certain computer systems such as those that run the Unix (or Xenix) operating system.

Other languages, such as APL, FORTH, and LISP, are available on small computers and used in more specialized applications in industry as well. BASIC, COBOL, FORTRAN, and Pascal, however, are safer bets for career possibilities. If in doubt, look through your local classified ads under "Programmers Wanted" to get an idea of which languages are in demand in your area. Bear in mind, though, that most jobs advertised are for programming large-scale systems.

What about the highly touted PILOT and Logo languages? Would it be worthwhile to learn them?

PILOT is even simpler to learn than BASIC. Apple sells it as a "courseware development system" designed to make computer-assisted instruction easier. Using PILOT, however, does not give you a solid foundation in programming. Learn BASIC first, and you'll see what I mean.

Logo is an excellent tool for teaching youngsters graphics-oriented programming, but it is not enough of a general-purpose language to serve as a basis for practical computer programming.

At the same time you're learning BASIC, spend some time learning about general computer technology. I don't mean that you should build a computer out of electronic components obtained at your local Radio Shack store. Instead, just read about and study how a computer system works, what the component parts are, and how they interrelate.

Contributing editor William Barden Jr. lives in Mission Viejo, California, and writes about small computers. *What Do You Do After You Plug It In?*, a collection of his articles for *Popular Computing*, is scheduled for publication this summer (Howard W. Sams and Company Inc.).

Learn by doing. Don't approach the project of learning BASIC and computer technology by reading abstract examples in textbooks. Get on the computer and run practical examples. Your computer is a highly interactive tool for learning to program, one that should speed up the learning process many times over most college-level computer science courses. Many university computer systems are so overbooked that students have to come in during the wee hours of the morning to get computer time. With your home computer, you have more power at your fingertips than the typical computer science student at a large university!

In the process of learning, you'll probably be able to create practical programs that you can use in your home or small business. I know that this feature of small computers has been oversold, but you can easily create your own programs for doing analysis on investments, home finance, heating costs, and the like.

Don't expect miracles in a short time. A typical college course covers BASIC in a semester—about 100 hours of class work and home study spread over 18 weeks. At the end of that time, the student has learned just the rudiments of BASIC and is probably not yet an efficient BASIC programmer.

Pursue a planned course of study. Ah, that's the rub! How do you establish a planned course of study? One way, of course, is to use your home computer system with a formal class at your local college. Another is to pick a good tutorial book. A third is to use a software course available on some computer systems. We'll cover these options in the remainder of this column.

Computer Programming Courses

If you're like many of us, you may need the rigid schedule of a regular class for motivation. This kind of course is available from several sources.

Some large users groups offer classes in BASIC programming, applications programs (such as dBASE II), and computer technology. The classes are usually free and sometimes even have professional instructors. One big advantage of these classes is that they are closely tied to specific systems.

Many computer stores offer classes in general computer technology, BASIC programming, Pascal programming (especially for Apple systems), and assembly-language programming. A typical price is $75 for 16 hours of study. These classes are usually excellent because they are geared to a specific computer system, the instructors are very knowledgeable about the system being used, and the classes are local. In some cases you'll have to bring in your own computer. In other cases the class will have a battery of computer systems available for students and possibly even have a network set up to allow simultaneous loading of programs. One disadvantage is that you cannot usually use these classes for college credit.

Independent computer schools are proliferating like computer stores. These schools offer the same subjects as computer stores but appeal to a wider base of people. Prices are usually higher than those of computer stores, and the classes may not be as machine-specific as those offered by computer stores. Accreditation is often lacking at these schools, and instructors usually have no certification. Beware of some of the older computer schools. Many are excellent, but most teach you how to get jobs as computer operators, data-entry operators, and COBOL business programmers on large-scale IBM systems. That's fine if it matches your goal, but here we're concentrating on schools that are really geared to small-system programming.

Your local community college or university also offers courses in computer technology. Classes last about 16 weeks and meet about six hours per week, split almost fifty-fifty between lectures and laboratory work—running programs on the school's computer system via terminals in several locations. Typical courses often include: Introduction to Computer and Information Science; Computer Operations; BASIC Programming; BASIC Business Programming; Pascal Programming; COBOL Programming; Advanced COBOL Programming; COBOL Business Applications; FORTRAN Programming; Systems Analysis and Design; and Assembly Language. Your own college's courses may differ considerably, however.

The advantages of courses offered at a college or university are obvious—certified instructors and academic credit if you want it. Also, many companies reimburse you for such job-related courses.

Still, the disadvantages might be considerable. Although the trend in business is toward installation and use of small-computer systems, many college courses teach BASIC, COBOL, and FORTRAN as used on large mainframe systems, which might be substantially different from small-system languages.

In addition, colleges sometimes use archaic technology. Some schools still use punched cards, a data-storage medium that was popular in the '50s and '60s but is definitely not typical today. Also, you will probably not get hands-on time on any computer system except a terminal, which will not resemble your computer's operation in any way. Investigate these courses carefully to see what systems are used and how current the technology is.

Tutorial Books

Have you looked at your local B. Dalton bookstore lately? I just traveled across the country and in the process made surveys of computer books in stores. A typical medium-sized chain bookstore has six shelves with 400 separate titles on computer books! And probably 2500 different titles on small com-

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puters are now in print. In talking to various publishers, I've found that all are eagerly trying to acquire new titles in the computer field as fast as they can be penned.

There's no doubt that you'll find books to teach you BASIC on your specific system, books to teach you assembly language on your system, many books on general computer technology, and, to a lesser extent, books on higher-level languages that are machine-specific. Which books are best? Here are some tips to help you decide:

Look first for machine-specific books. You want to learn how to write BASIC programs for your own system. Machine-specific books are especially important if you're learning assembly language, in which the architectural quirks of different systems have major implications for how programs are written.

Look for books with solid, practical examples along with tutorial text. Don't work in the abstract in programming, but rather work with programs that accomplish visible results.

Try to find a book that offers a genuinely progressive, step-by-step tutorial in BASIC programming or other subjects. Avoid the quickie books that offer only a beginner's guide to your system. By all means, avoid books that promise to teach you BASIC in two days!

Find out which text your local computer store uses in teaching the subject. You might also find out which text your local community college uses, but be wary—it may not be comprehensible without the lecture material.

Interactive Computer Courses

Many small-computer manufacturers offer what I think is the best way to learn BASIC or assembly-language programming—a highly interactive tutorial course designed specifically for their machines.

Radio Shack offers a number of Computer Learning Labs for their products. The Computer Learning Labs use a step-by-step printed manual and lesson programs that you load from cassette or disk files. After loading a lesson program, students refer to the manual to run and modify the program. These labs are a painless way to learn BASIC programming—at least the rudiments.

Another example of the Computer Learning Lab concept is an assembly-language course I've implemented for the Radio Shack TRS-80 Models I and III. The course consists of a large manual, lesson programs on disk or cassette, and a control program. Students load a lesson program or type in the lesson in conjunction with the printed text. The control program prevents the assembly-language program from "blowing up" and is extremely interactive, letting students know when they make an error in coding, what type of error has occurred, and so forth. It is virtually impossible for students to lose control of the computer, a common problem when novices attempt assembly-language programming.

This type of machine-specific interactive course is an effective and enjoyable way to learn computer programming and computer technology and will undoubtedly be offered for most computer systems in the near future.

I hope that this column has given you some ideas on how to learn computer programming at home. Armed with your own computer system, you'll find the process a great deal easier than it was 10 years ago. You won't have the equivalent of a doctorate in computer science when you're finished, but you may, in fact, have an excellent basis for implementing your own home or business programs or even advancing your career. □

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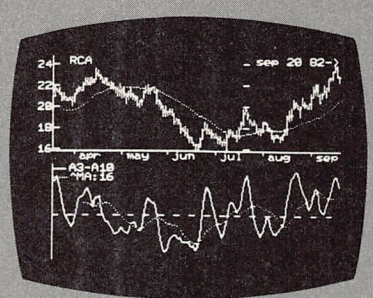

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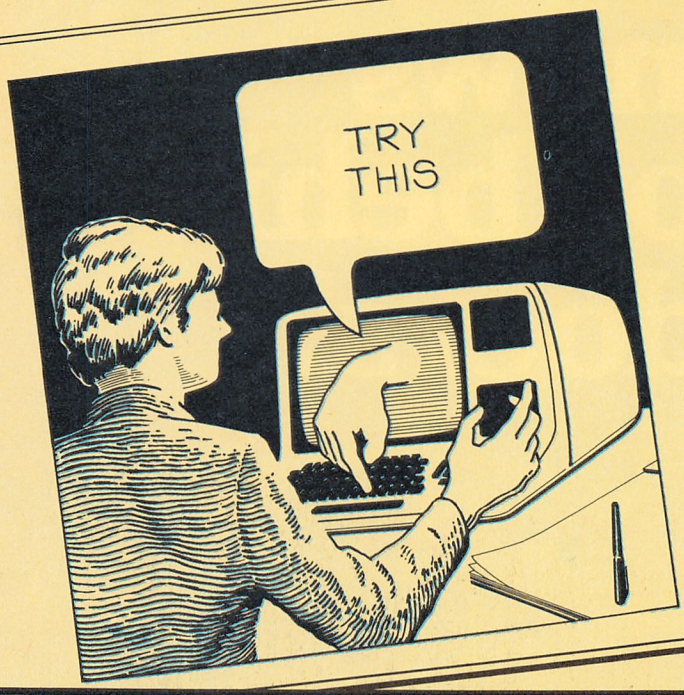

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Teaching in the Computer Age

These days it's a struggle just to stay one step ahead of the class

by Dan Watt

One hundred years ago, the influx of immigrants from southern and eastern Europe put severe strains on American education. To help the newcomers and their children become literate in English, dramatic changes in educational methods were implemented virtually overnight. As a result, teachers bore the brunt of a major change in society.

A similar scenario is playing itself out as we enter the computer age. Once again, schools and teachers are at the focal point of a rapid social transformation. But this time, it's not only the students but the teachers themselves who have to learn a new form of literacy almost overnight.

Within the past few years, we've seen a series of educational reforms designed to foster what some people call computer literacy, technological literacy, or information literacy. Whatever the name, the effort to provide this kind of education for everyone will present a major challenge for our schools and teachers for the rest of this century.

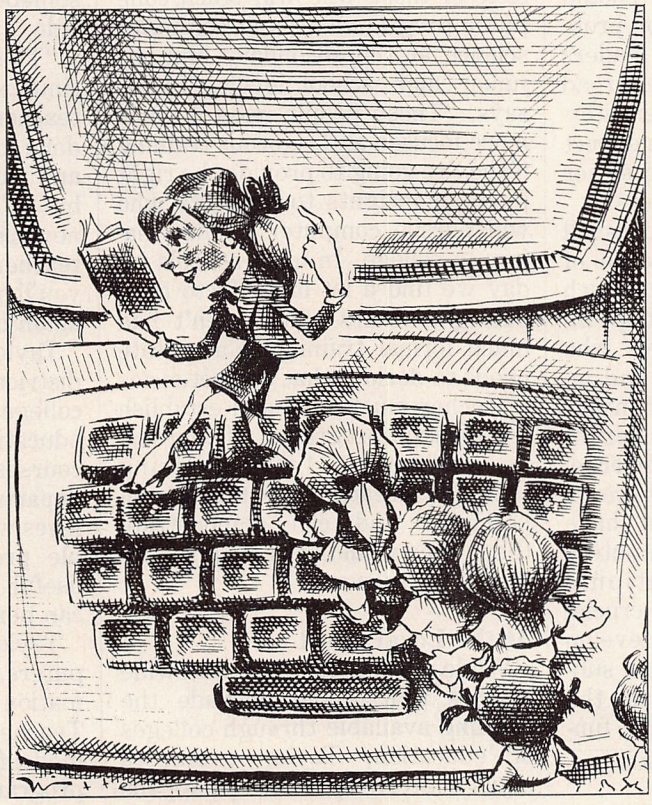

Illustration by Michael Witte

Growing Up Literate

If we stop to think about how children grow up literate—in the old-fashioned sense of reading and writing—we must admit that formal courses in English and language arts represent a significant but relatively small part of the process. Even more important than formal training is the fact that children grow up in a literate culture. Everything and everyone around them—parents, teachers, older friends and siblings, the entertainment and news media—promotes the value of literacy.

In school, all teachers—not just the English teachers—support the importance of literacy. Moreover, children *use* reading and writing—in and out of school, for personal and academic purposes—from the time they first learn to read simple words and form the letters of the alphabet.

When we talk about computer literacy or information literacy, then, not only are we talking about formal courses, but we're also talking about a technologically literate *culture* for children to grow up in. If schools are to play an important role in creating that culture, teachers must become literate themselves. Preparing teachers involves training not only those teachers who will teach specialized computer courses—the "English teachers" of the computer-literate society—but preparing *all* teachers to provide a culture of literacy.

A Top-Down Perspective

Professor Robert Taylor directs the program in Computers, Communication, and Informa-

tion Technology at Columbia University's Teachers College in New York City. For several years he has been involved in a national task force to determine what teachers need to know about information technology and how they can get the training they need. Now working with educational leaders in New York and New Jersey, Taylor is trying to influence long-range planning for teacher training in each state.

Teachers must take what they already know about teaching and learn how computers can eventually make a difference to their students.

Taylor identifies two fundamental problems in dealing with state and local officials and faculty members at teacher-training colleges. Says Taylor, "People at this level know almost nothing about computers. They don't know how to run one or what to do with one. Also, they don't have any idea of what a coherent program should look like or what the major problems are." Educational leaders must first understand the broad issues involved in computer literacy training before they can expect to provide specific training either for themselves or for teachers.

According to Taylor, teachers fall into three broad groups, each of which needs a different approach to training. The first group includes teachers at all levels who will be teaching computer and information literacy, whether in formal courses or informally as part of other subjects such as science, math, or social studies. This group, Taylor says, does not yet have enough experience with computers or adequate instructional materials. For them it's crucial that educational leaders develop the materials for a particular subject and age group and train the teachers to use them. The fundamental idea is that teachers must go through the same experience that the kids will go through. "The materials should be designed by experts and probably won't come from local school districts or even from the colleges of education," says Taylor.

A second category of teachers who need training includes those who plan to *use* computers in nontechnical subjects. The amount of training may vary according to the extent of computer use involved, but Taylor believes that the software and instructional materials must still be of the highest quality and that teachers must go through the same experiences as their students as part of their preparation to teach.

A third category of teachers consists of those who will teach computer programming and computer science at the secondary and the junior high school levels. Taylor says, "These people need a much more focused and rigorous training if they're going to provide the right kinds of insights to students who will pursue computer science majors in college. In most schools today we find a lot of de facto computing teachers who haven't had much formal training. Each state needs to decide what competencies a teacher must have and establish certification programs. Of course," he continues, "if practicing teachers already have these competencies and can demonstrate them, they wouldn't need any more formal coursework."

At the Local Level

While pushing hard for statewide policies that would upgrade the training available through colleges of education, Taylor expresses equal concern about what happens at the local district level. "Having a coherent in-service model for practicing teachers is at least as important as preservice training," he asserts. "But a school district has to realize that it's going to cost money. Buying the hardware is the least of it. Providing the release time for teachers at all levels will be a major expense."

"A school district needs to do several things," says Taylor. "First, a district must designate two or three people from each school to be computer experts in residence. These people must be given time off and some financial support so they can get formal training. Once trained, they must be given regular release time so they can function as experts. If you stick these people with full class loads themselves, they won't be able to help others very much.

"Next, schools have to allocate money to bring in outside speakers to do what I call 'psyching up.' A school's own experts will never be able to keep current on everything, nor will they enjoy the prestige of somebody coming in from the outside.

"The final requirement is a continuous training program for the teachers in residence. It may be done partly by the local experts and partly by people from outside, but it's crucial that the training never ends. If you train a group of teachers for 10 weeks one year, you'll have to train the same people again in two or three years."

Taylor hopes that local school districts will put pressure on the colleges of education and on state education departments to provide courses for teachers. "Most state departments and education colleges won't do anything unless people pressure them. So this is a useful service that local districts can perform," he states.

Taylor's own program in Computers, Communication, and Information Technology at Columbia's Teachers College could serve as a model for other colleges developing programs in educational comput-

Dan Watt is a contributing editor of *Popular Computing*.

ing. The Teachers College program, which has grown rapidly during the past five years, includes courses both on programming and on the use of computers in various disciplines. "We feel that knowing something about how to program is at the heart of this kind of activity," Taylor explains. "So everyone takes a standard introduction to programming, using a special approach that we've developed. We also offer courses on teaching programming and on communication and instructional design. Other courses include software development, software evaluation, computers and writing, computers and language arts, and a new one on computing in the social studies. The basic thrust of the whole program is that computing is a form of communication. Computing will merge with networking, telecommunications, and video in the next few years, so we have to take the whole area of communication into account."

Teachers must feel comfortable taking what they already know about teaching and learning how computers can eventually make a difference. It's important, however, that they find out what a computer can do before they try using it in particular subjects. Most teachers start out looking for specifics. They feel that unless they can come up with software for their biology or English class, they won't know what to do. Once they take off their blinders and look at computers more broadly, they can find lots of applications for their disciplines and have a much better frame of reference for finding and evaluating software.

Teachers on Their Own

Is there any way teachers can start to become computer literate on their own? Taylor says that they should pressure their local school districts, teacher-training colleges, and state departments of education to provide training opportunities. They can also seek out regional conferences. Taylor suggests that teachers read computer magazines and one or two books about computer education, even though they may feel overwhelmed at first.

Other educators feel that a do-it-yourself, hands-on approach has a lot of potential. Once teachers buy their own computers, they become aware of other people around them doing the same thing. It's an easy next step to get together informally with other interested people to share ideas and experiences on a regular basis.

The beauty of teachers staying one step ahead of their students is that their learning process is fresh. It's scary, frustrating, and exciting. But isn't that what education is all about? □

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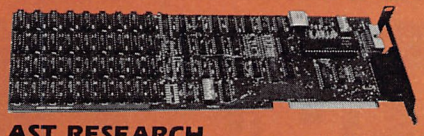

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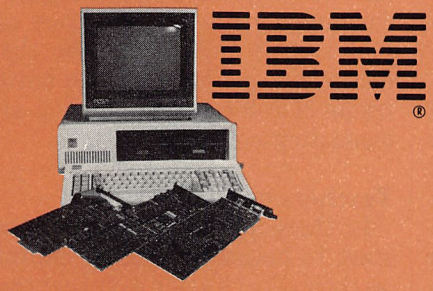

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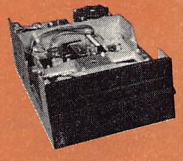

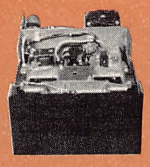

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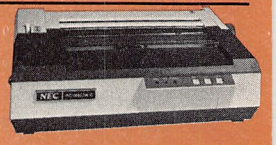

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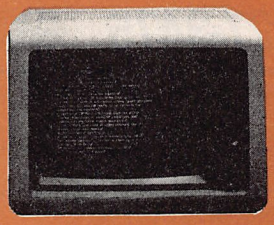

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Modem Wars

Feeling blue? Reach out and battle someone in telecommunications space.

by Steven Levy

Sometimes it gets kinda lonely here in this electronic cottage. Sure, there's plenty of work to keep you busy, and when you've got some steam to blow off, there are copies of Choplifter, Crossfire, and Repton around. But after an hour or two (or three) of shooting Quarriors and Bungelings, you get this empty feeling and ask yourself, "Who cares?" Does your Apple really give a microsecond's thought to the fact that you've mastered its reflexes to the point of Level Three? As you look out the window and see the sun start its rise, you feel a little worthless, playing games with yourself all this time.

It seems much more healthful, and much more fun, to play games with a real-life person. Trouble is, real-life friends aren't always around. And when they are, they sometimes profess that they have other things to do than play Monopoly. This has been a dilemma since King Arthur set up his chessboard on the Round Table, called for an opponent, and was reminded that all the knights were out on quests. However, for perhaps the first time in history, problems like this need no longer exist for most of us.

Careful readers of the column heading above will divine why. I'll give a hint for less scrupulous readers: telecommunications. With a computer or terminal, a modem, and a partner or two, some good old-fashioned competition is just a dial away.

Like most everything else in this dawning age of computers (maybe by next year we'll be through with dawn and into early morning), game hustling via modem is in its exploratory stages, where the thrill comes in three fairly equal parts: the fact that you're doing it, the fun of doing it, and the anticipation of how good it's going to be when the technology finally allows you to do it right. The sum of these parts even now adds up to a pretty satisfying whole, though, as I found in my search for some gaming action on computer networks.

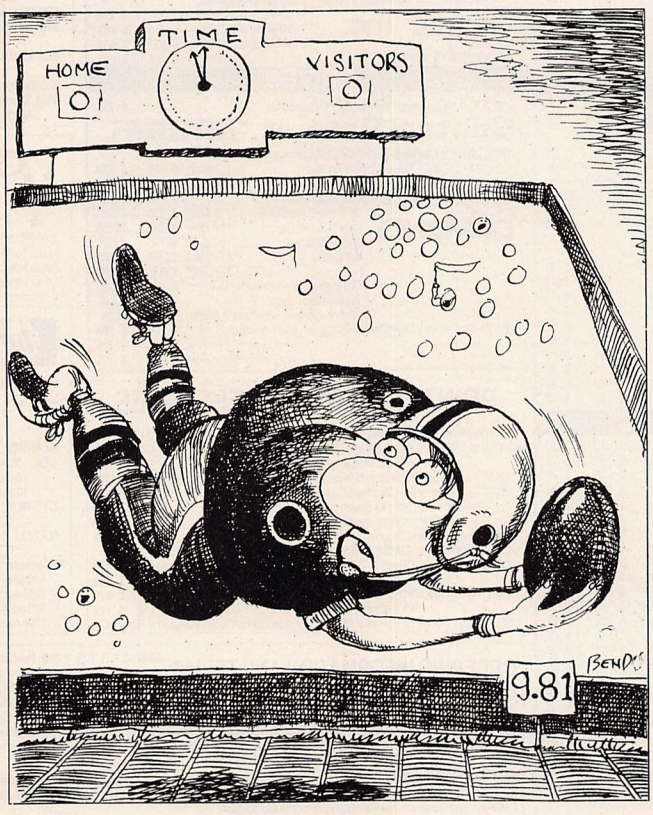

Illustration by Keith Bendis

Mind you, interactive multiplayer games are not exactly newcomers to computer networks. I was reminded of this recently when visiting a wizard-level systems programmer at the headquarters of his employer, a large technology firm. In his office, right next to his bit-mapped computer monitor, was a board game opened to reveal a map of the world. It was dotted with little wooden markers of various colors. Each color owned a chunk of the world, and the master of each color was in a different part of our real-world country. My friend, who was France, was rather worried. As we spoke, his machine beeped, heralding the

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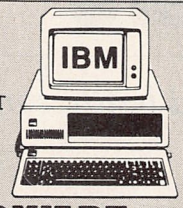

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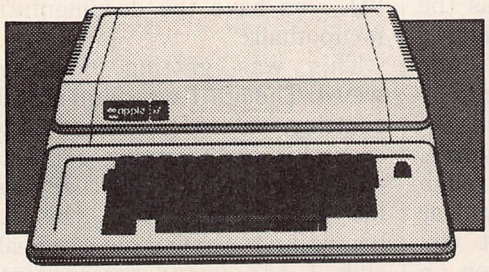

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next move from the Soviet Bloc. The name of this game, played over an exclusive computer network run by the United States government, is Diplomacy, though it looked like War to me. Various rounds of this game have been played via the network for over 10 years.

Gamemaster Mansion

When you present an old idea in a different setting, however, it gains a new vitality. At least that's what I felt when I visited the Gamemaster's house. Currently small, but full of hopes and pretensions for a wild future, the Gamemaster Mansion might well be a paradigm for interactive gaming. The house is located inside a 272K Alpha Micro computer in the Chicago suburb of Evanston, Illinois. The winding front path is the international nexus of telephone lines leading to the 312 area code. You drive there by modem.

On bulletin boards and at computer fairs I had heard rumors of this place where strangers regularly meet for stirring competitions. I'll confess I hadn't quite grasped how it works, so I made sure I did before I arrived unannounced to check in with founder and resident game master Harlow Stevens.

He sounded genuinely cheered to hear from me. To be brutally frank, I got the impression that poor Harlow, one of those innumerable wunderkinder in their twenties who somehow seem to lock into the fast lane of computer entrepreneurship, was a bit puzzled that Gamemaster wasn't setting the computer world on fire. Oh, it was doing all right, thank you—it's just that Harlow and his partners (former frat mates in college, hackers and gamers all) had figured that Gamemaster would be franchised to several other cities by now. I mean, it's already been three and half years since they started.

"We really should have 20 or 30 Gamemaster clones in different metropolitan areas," he says. He sees how his customers love the system—some gladly swallowing long-distance costs as well as the $3-an-hour online fees—and figures that it's just a matter of time before franchisers see the light.

After a couple of visits to his remarkable house, I tend to agree. First, of course, I plowed through the unassuming but relatively clear documentation Stevens sent me, after which I was able to log on without a problem. A "doorkeeper" let me in, and on my screen came a description of a grand foyer that is the central location in the six-story, 39-room mansion. (Fortunately, a map is provided with the documentation.) From this point, I could move around the house by giving directions, much as in an adventure game. Or I could energize myself through a portal and go directly to any room in the place.

The choices were dizzying. Most rooms had games, both solitary and interactive. Other rooms had communications services, like the mail room where I could leave messages for people or the alcove where I might check a blackboard for notes from those in the house. I could also use the public-address system to send a message that would notify other visitors that I was here and cruising for action. I could even visit the kitchen and get some cooking hints.

Stunned by this panorama, I was frozen until my inactivity was noticed by Harlow Stevens himself, who was monitoring the system (as he does 12 hours a day or so). He broke the ice by barging in on the PA and asking me if I'd like to chat in the parlor. I transported myself there and was able to chat with him via computer. I asked if he wanted to play, and he said yes.

"What two-player game would be good for a beginner like me?" I asked him.

"Football is easy and a good game," came the reply. When I typed in agreement, he responded, "Meet me in the locker room."

I transported myself there and waited until a message came that Stevens had arrived. "Hi," he said. "Do you have the documentation for football?"

This was getting downright weird. Though I was familiar with chatting via modem and could get around in an adventure game, the experience of both together was a bit disorienting. Also, this was beginning to remind me of a health club I had joined some months back. You'd go in, show your pass, go down to the locker room, up to the exercise room, down to the sauna.... But that was reality, and this was a computer game. No, wait, this wasn't a plain old computer game; somewhere across the country was a real person in this locker room, er, computer. And we were about to lock in mortal combat on a computer football field.

Whew. I hit my return key to leave the "talk" section of the locker room and chose two-player football from the resulting menu of sports games. Harlow did the same, and after he won a computer dice toss, we were under way.

Two-Player Football

The football game on Gamemaster is simpler than its labyrinthine dungeon games, its elaborately charted Nuke Attack game, or its statistics-laden cross-country trucking game. Basically, one player chooses from 20 or so offensive plays while the other picks a defensive formation. Depending on how well the formation works against the offensive play (with some randomness thrown in, I assume, to keep things interesting), the play is scored as a loss or a gain. The program, showing off a bit, computes these losses and gains to the second decimal place. Meanwhile, a clock ticks off time—not real time, but an estimate of how much time would have elapsed in a real football game.

Placing my defensive men was easy. The computer asked me how many men I wanted on the front line, then how many linebackers,

Steven Levy is a contributing editor of *Popular Computing*.

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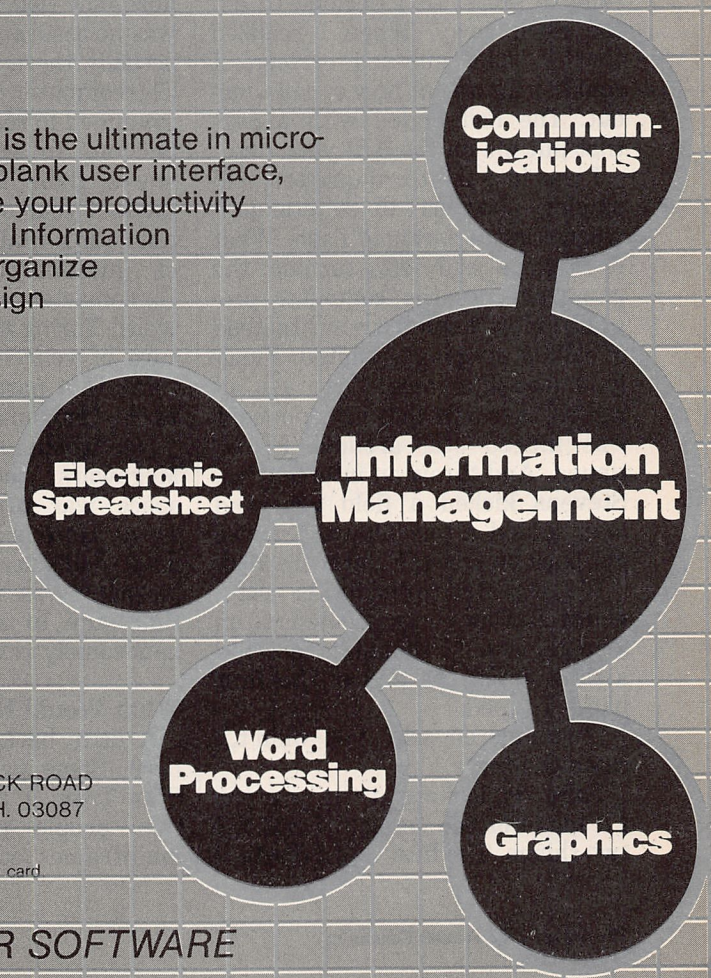

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then how many backs. It thoughtfully printed back what I had chosen in case I made a typo or changed my mind. I did pretty well, stopping the more experienced Harlow Stevens for much of the first half. As the half ended, I was driving for a touchdown. It was only too late that I began to notice that time was passing much more quickly than in a regulation NFL game. Years of listening to John Madden insisting that three minutes in a football game is "time enough for just about anything to happen" had lulled me into thinking there was no rush. I figured I probably had more than enough time to score, so I decided to eat the clock away. When I realized that I had guessed wrong, I couldn't figure out how to call time-out. The half ended with a pass that put me on the 9.81-yard line.

I was into the third quarter, still playing Stevens to a standoff, when I got a paranoid flash. What if Stevens had left, turning the game over to the computer program? How would I know? Instead of calling my play, I waited. Finally, a message came: "Are you all right?" Assured that my opponent was indeed still around, I continued. And threw an interception. Stevens kicked a field goal and later added a touchdown. I never got back on track. Final score 10-0.

We retreated to the locker room, where Harlow congratulated me on a good game. "I should have called a time-out at the end of the first half," I typed.

"I wondered why you didn't," came the reply.

Later on, looking at the printout I'd made of the session, I noticed two things. The first was a discrepancy in the transcript of my abortive drive at the end of the first half. After the two-minute warning had been called and the clock supposedly frozen until the ball was snapped again, I chose my next play. But before the play began, 18 more seconds had elapsed on the clock! This seemed a gap more nefarious than Nixon's 18-minute whopper. I could have gone all the way with those 18 seconds! Call Pete Rozelle! Call Marvin Minsky! Harlow Stevens, I protest!

Making a simulated kill on someone you'll never meet is sobering. Could I really inflict misery on an 11-year-old hacker in Dayton or crush the hopes of a homemaker in Houston?

The second thing that occurred to me was even more disquieting. Remember when I paused to make sure Harlow was really there? I realize now that the reply I received was no assurance at all that he was actually there playing against me. The computer could have been programmed to respond to lulls in that fashion. In short, once a game starts, there is really no way to know if your opponent is the computer or a real person. If this sort of question bothers you, each Gamemaster session would be a weird Turing test to gauge the nature of your competition. I don't think that paranoids would thrive in the Gamemaster Mansion.

Nor would they do well to play Megawars, the epic interactive space war available on Compuserve. Here is a game where paranoid delusions come true—total strangers, as many as five at a time, try to shoot you and are handsomely rewarded for doing it!

What Would Kirk Do?

A little background is in order here. Some years ago there was Star Trek, a public-domain game that people played on hulking mainframe computers, usually printing it out on screeching Teletype machines. Based rather loosely on the plot of the television show, the game put the player in the boots of Captain Kirk, piloting the *Enterprise* through hostile territory, docking at friendly star bases, and fighting off the Klingons with an assortment of photon torpedoes and phaser cannons.

But in the Columbus, Ohio, offices of the online service Compuserve, whose vice-president Bill Louden says that "we consider the entertainment sector to be crucial to our business," the old Star Trek was transmogrified into an interactive game called Decwars. This proved popular enough to be expanded into the current mammoth version called Megawars, designed by Louden and written by a team of in-house programmers. Since last August, the Megawars galaxy has been visited by about 2000 subscribers each week at what Louden estimates as an average of $10 per interstellar adventure. Megawars has spawned a cult of desktop gladiators; when they are not pseudonymously piloting spaceships, cruising the cosmos, and blasting opponents, they are buying Megawars posters and T-shirts or making comments on the dedicated Megawars electronic bulletin board.

Though never a devotee of Star Trek or its offshoots, I felt that the interactive properties of Megawars made it a must-play experience. So I sent for the 38-page Megawars manual, without which I would never recommend even attempting to access the game. (You can order the manual by accessing Compuserve's feedback section.) I read the plot that Bill Louden has devised for Megawars, a plot different enough from the copyrighted Star Trek scenario to avoid Lawyerwars.

Apparently, 700 years ago a bunch of intergalactic hoodlums called the Kryons established an empire and "exported their culture of slavery and dictatorship." The oppressed Colonists of the Galaxy

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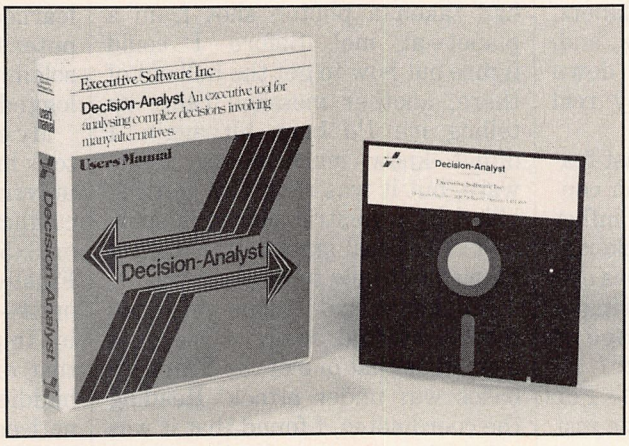
Faced with a fall and winter of virtually no sales, many thousands of dollars of unneeded parts and excess production staff, I had no choice but to shut down the production lines. And if a solution to our problem could not be found, the business itself was in jeopardy.

A life saving decision

I spent many sleepless nights trying to come up with a solution to this nightmarish situation. Then I remembered a course I had taken in decision analysis. I spent the rest of that night reviewing course material and other books I had bought on the subject. The next day, I called an emergency meeting.

Using the decision making techniques I had learned, we spent the rest of the week searching for and analysing potential solutions. The net result was that not only was the company pulled back from the brink of destruction, but we added over $1,000,000.00 in gross sales during that off-season.



A way of life

From that point on, almost every critical decision (and there were many) regarding new products, marketing channels, pricing, advertising, production equipment, engineering projects, received this same type of analysis.

Although the process was very time consuming and clumsy, because it had to be done by hand, our decisions were much improved. And there were some real benefits that we had not anticipated.

1. Our understanding of each problem was greatly increased.
2. We uncovered opportunities that we would not have thought of in any other way.
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have spent these past seven centuries fighting and repelling the Empire's every thrust. You the Compuserve user get to choose which side you want to join, and you jump into the fray *in medias res* with the object being to help your side win this particular battle of the Megawar. Battles, as far as I can see, run anywhere from a few hours to a few days. (Fortunately, you can log off at any time without shame.) You accumulate points both for your side and on your individual scorecard by such activities as capturing neutral planets, destroying enemy star bases, and, not at all least, gunning down enemy ships commanded by real people.

I have to admit that this last feature sparked my imagination considerably. Could I really inflict misery on an 11-year-old hacker in Dayton, Ohio? Crush the hopes of a homemaker in Houston? Bring a computer consultant in Chicago to his knees with my phaser fire?

Not right away I couldn't. For one thing, it helps to memorize just about the whole manual before you get started on Megawars. When things start to happen, you have to know what to do right away. Like real war, you get no second chance.

My poor ship, the *Demon*, was something of a clunker anyway. You see, as a cadet I was given a training fighter (the beginner's ship—only with subsequent promotions that come with high point totals can you get the faster, more destructive spaceships). This was just as well, because I could hardly figure out how to move. My intrepid comrades in the Empire kept asking me if I were all right, and when I figured out the command for answering them, I replied lamely that I was pretty new at this.

I thought I'd get some practice by capturing a planet or two—no reason to engage in combat with a real person right away. So I scanned my sector of the galaxy using a command that evoked a grid-like output on my screen identifying where I was and what was sharing my little corner of the universe with me. After a tortured series of moves, each time praying that some experienced Colonist wouldn't chance upon me, I did discover a neutral planet and sidled up to a point several sectors away from it to pitch in a few torpedoes. While I leisurely thumbed through the manual to figure out how to do this, the screen erupted with one of the interminable status messages that Megawars frequently delivers. This one said that the *Demon* had taken a photon shot from a planet—at me! Before I could figure out how to get the hell out of there, another message came up telling me I'd been hit again. I didn't know much about Megawars, but it was clear that getting killed by a neutral planet is some sort of colossal ignominy. Finally I figured out how to move away.

No sooner had I done this than trouble started again. A message alerted us that one of the Empire's bases was under attack. Reading the coordinates, I found that it was only a few moves away from me. I swallowed hard and decided to seek revenge. But my next move took me inadvertently near a Colonist planet, which promptly fired a few photons at me. By now, the power in my protective shields was down to about 50 percent.

While I frantically tried to get away from the hostile planet, the messages started pouring out once more. Nine sectors away (you can shoot someone from up to ten sectors away) was the *Scorpion*, not an ally. He made what is called a "32.4-unit phaser hit" on my ship, then a 33.6-unit hit. Before I could even consider a proper response, I was informed that a ship called the *Viper*, only three sectors away from me, had made phaser hits of 65.5 units, 70.7 units, 69.4 units, 37.6 units, 31.8 units, and 41.2 units. Then the *Scorpion*, my first attacker, pitched in more hits.

Occasionally the Colonist planet, which I never did move away from, tossed a few more photons into my battered hull. I couldn't figure out how to stop the output of this information long enough to do a thing, so I watched glumly as my shield's energy faded to naught and I was destroyed. Somewhere in this twisted country of ours, two people at computer terminals were laughing their butts off.

The Empire Strikes Back

A lesser man might have given up Megawars for life. But I reread that manual and figured out how to make a few moves at once. I learned to use my shipboard computer to fire at enemies. I took the solemn vow of the Empire and logged on once more.

My ship this time was the *Wolf*. I took my time, getting the lay of the universe. I noted where there was conflict and wrote down locations on 3x5 cards. I scanned frequently. Finally, a message came that a Colonist—my foe—was firing at a nearby Imperial star base. I moved in that direction. One of my Empire buddies, the *Delphos*, had also noticed, but the *Levant*, the Colonial ship, had seen him first and landed a photon torpedo hit.

By then I had my command ready: PH C L. That means to use the shipboard computer to aim phasers at the *Levant*. The screen read: WOLF @54-24, +100.0% MAKES 389.2 UNIT PHASER HIT ON LEVANT @46-25 -8,+1, -24.2%.

A hit! I leaped out of my seat and howled with glee. Then I went back to the keyboard for another shot at that sucker. Before I could even get a character down, the output told me that the wounded *Delphos* had shot two torpedoes at the evil *Levant*. Good work, *Del*! As soon as the output stopped (it seemed endless), I typed in the phaser command again. I was out of my chair, pounding at the keys. And like some sort of magic, these characters appeared on my screen: WOLF @54-24, +100.0% MAKES 340.8 UNIT PHASER HIT ON LEVANT @44-27 -10,+3 LEVANT DESTROYED!!

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The Victory Sours

At first I did a Mark Gastineau victory dance, hooting like a loon. But suddenly I realized that this was not the same as clearing the board in Space Invaders—there had been a real person piloting the *Levant*. Though I am a fairly competitive person, I must admit that the experience of making a simulated kill on someone I would never meet was rather sobering. If we had been face-to-face, some joke or comment would have relieved the tension. We might have gone out for a beer. But I felt empty—probably much worse than the captain of the *Levant* felt.

So with less joy than I'd anticipated, I left the Megawar. The Compuserve computer was kind enough to tell me my score. For my damage to the *Levant* I had received 615 points, only 9035 points short of a promotion to lieutenant and many more points short of a lifetime high score held by someone who calls himself Unc.Megawar. He has over two *billion* points—and has broken who knows how many hearts.

For the next day I pondered the issues of interactive computer telecommunications games—how you never could be sure if the computer was engaging you in a giant put-on, how stupid you felt when you lost big, and how badly you felt when you won big. I pictured a world where most play took place between people alone in their rooms, hacking on terminals with the graphics capabilities that only now online services are getting their hands on, playing incredibly addictive games with high-resolution video, personalized modes of behavior, and sensory controls so sensitive that a blink of an eye could wipe out your opponent in Maui or Montreal. I shuddered. Still, the next day I logged on for another round of Megawars.

What the heck, I was bored. And I wanted someone to play with. □

For More Information

To find out more about the multiplayer game sources mentioned in this article, contact:

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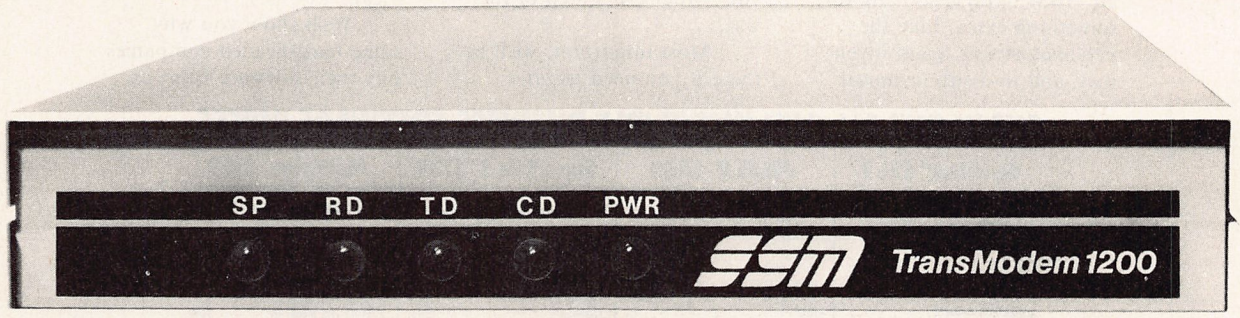
Editor's Note—Steven Levy welcomes your comments, hints, and suggestions about telecomputing. You can contact him on The Soure (ID TCT670), Compuserve (ID 72065,635), or by writing to Telecomputing, POB 397, Hancock, NH 03449.



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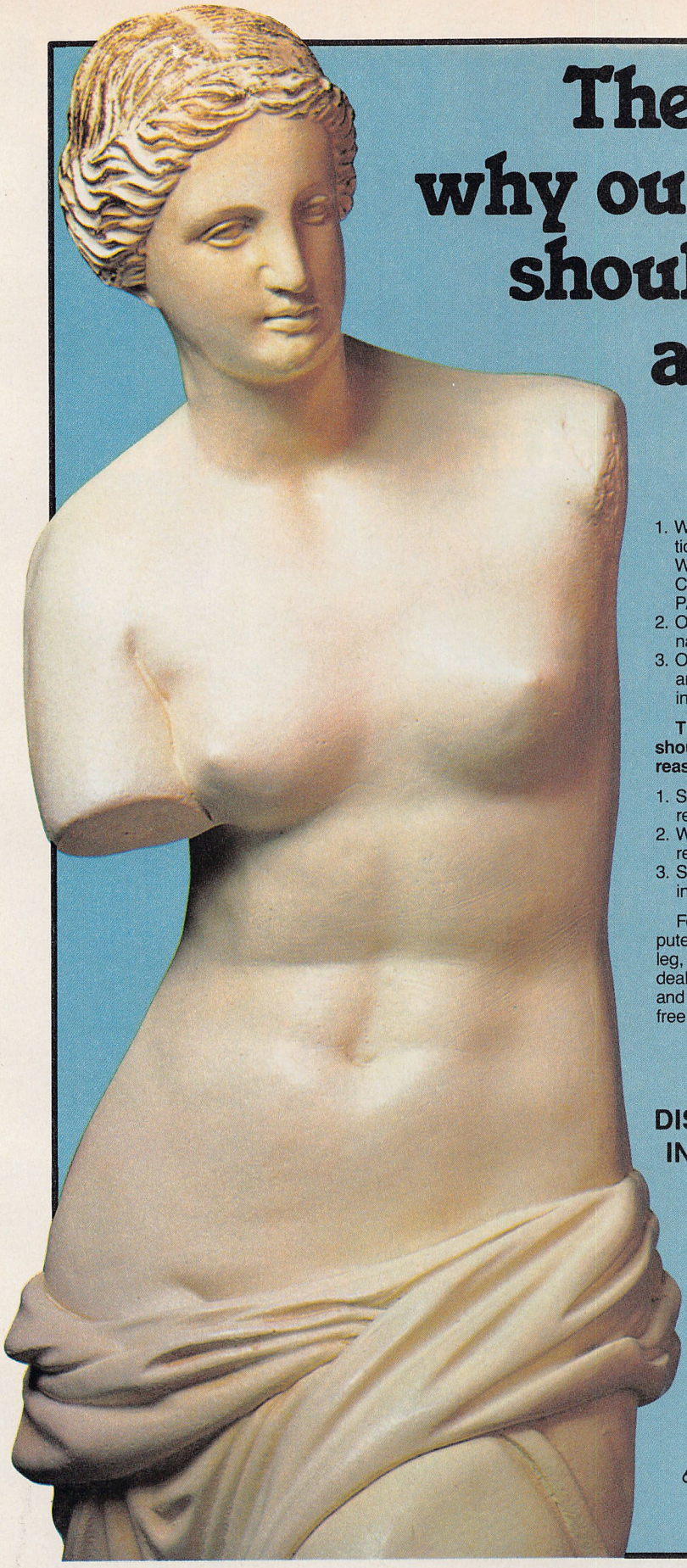

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COMPUTERS I

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Computers force educators to rethink the learning process • By Edward Fiske

Computer Education: Update '83

PART TWO

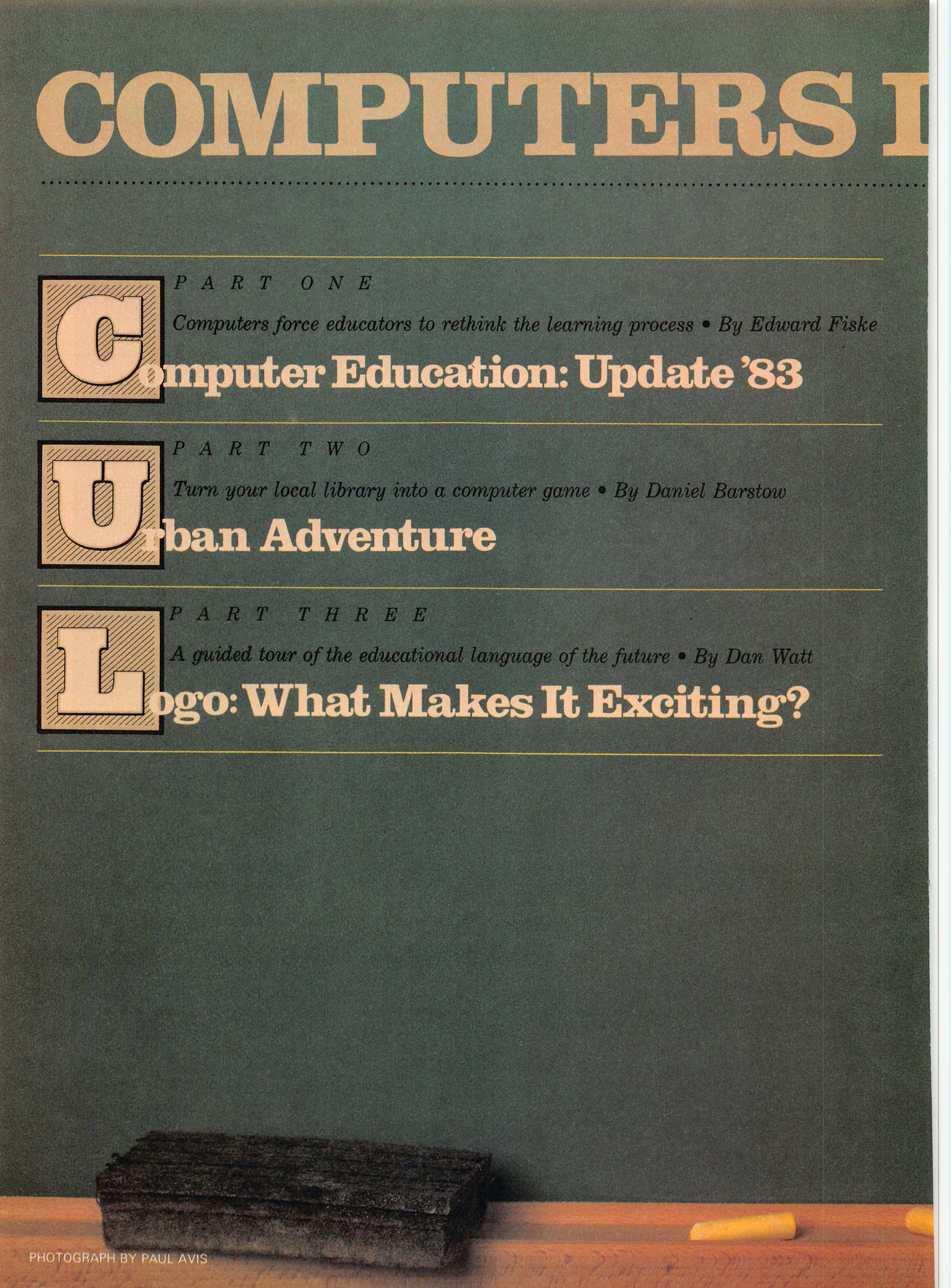
Turn your local library into a computer game • By Daniel Barstow

Urban Adventure

PART THREE

A guided tour of the educational language of the future • By Dan Watt

Logo: What Makes It Exciting?



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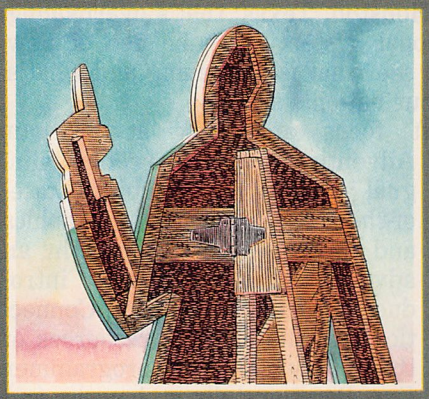
N EDUCATION



GIL EISNER

Is Computer Education Out of Control?

Schools are in the grip of a computer mania. Ordinarily conservative and slow to change, schools are embracing new technology and new educational methods more rapidly than they can learn to use them. During the past few years, the influx of microcomputers in education has grown from a mere trickle to a torrent, engulfing teachers and administrators in a flood of confused expectations and unfulfilled promises.

Changes are taking place so rapidly that it's not at all clear who's in charge. Are the computer manufacturers and software publishers pushing computers into the schools? Or do school administrators, school boards, or individual teachers have the ultimate responsibility for making decisions about purchasing and curriculum? The frightening answer may well be that no one's in charge! There's no master plan, no one at the helm—just innovation for its own sake.

Pressures from many sources are combining to push schools rapidly and irrevocably into the information age. Hardly a day goes by without a story in the media about how technology is changing society,

or about how we may be losing the high-tech race to the Japanese, or how there are not enough workers for technical jobs, despite record unemployment.

Additional pressure comes from the marketplace itself. Hardware and software vendors and educational publishers are all moving aggressively to capture a lucrative piece of the action. Rather than slowing down and carefully examining their long- and short-term goals, school districts are scrambling for the latest technology, the most elaborate systems, and the lowest hardware prices without fully knowing what they are going to do with computers when they get them. Although it is almost universally acknowledged that educational software is still in its infancy and that most available software is inadequate and unimaginative, schools have little choice but to purchase and use the software that's available.

Computer literacy has become a political football. No one can tell you exactly what it is, but everyone feels it's good for us.

Educational publishers, who traditionally take at least five years to develop and test a new line of textbooks, are rushing into the educational software market, hoping to replace the standard type of workbook with electronic means of helping Mary and Johnny practice their spelling and arithmetic lessons.

Courses on computer literacy and computer programming are proliferating. Again, publishers are competing to be first, rather than taking the time to develop the best possible product. In the past year or two, computer literacy has become a kind of political football at the federal, state, and local levels. No one quite knows what it is, but everyone is sure that it's good for us. In the final analysis it is our schools that must bear the brunt of educating a technologically sophisticated population of workers for high-tech jobs.

But is the current wave of computer-literacy courses really what the next generation needs? Do elementary school children need to practice "keyboarding" or learn to write simple programs in BASIC or Logo in order to grow up computer literate? Do these courses give our children the conceptual basis for solving complex problems and handling large systems of information? The question is largely unexamined.

Another source of pressure comes directly from parents. In ever increasing numbers they're sending their kids to computer camps and buying computers for their homes. Future Computing Inc., a Richardson, Texas, market research firm, predicts that by 1987, the combined market for educational hardware and software will have reached $1 billion per year and that approximately 70 percent will be products for the home rather than for schools.

In a special report on Computers in Education, *Popular Computing* looks seriously at what's going on in our schools. We kick off our special report with "Computer Education: Update '83," by *New York Times* education editor Edward Fiske. With a view that encompasses the human side of education as well as the technological, Fiske surveys the field as schools join the information revolution in earnest. From an elementary school on Cape Cod in Massachusetts that's just installed its first computer to the urban school district of Houston, Texas, that's overhauling its entire educational system to make use of new technologies, we'll see what is happening and what's not happening in our nation's schools.

Next, we shift focus and look at "Urban Adventure," a remarkable bilingual program that combines state-of-the-art technology in graphics and speech synthesis with an adventure game format to introduce children in Hartford, Connecticut, to the cultural resources of their city. Teacher/programmer Dan Barstow tells us how he and his students created the program and offers some pointers on organizing a similar program.

In "Logo: What Makes It Exciting?" Dan Watt explains the workings of the powerful computer language that can serve as a friendly and natural introduction to programming, a playground for mathematical explorations, and a vehicle for learning advanced computer science concepts. He takes you on a quick tour of the language, from the world of turtle geometry to the magic of recursion. He also reviews microcomputer versions of Logo.

In addition to our special report on Computers in Education, see our Educational Computing column on page 65 and our software reviews, which start on page 190. Educational Computing this month focuses on "Teaching in the Computer Age" and looks critically at the problem of teacher training and at what teachers need to know to stay one step ahead of their students. Our lead software review critiques Bank Street Writer, an easy-to-use word-processing program designed for children that's proving to be a useful tool for people of all ages. We also examine some new software designed for playful learning at home. Facemaker, Story Machine, and Snooper Troops from Spinnaker Software and Discovery Games for the Apple from Children's Television Workshop show that educational software doesn't have to take the form of drill-and-practice routines to be effective and doesn't have to mimic the arcade games to be enjoyable.

Education is everyone's concern. Our economic health and the survival of society may well depend on how successfully we educate people for a technological world. We hope our special report will give you the background to raise the questions and face the issues of education for the information age. . . . **D.W.**

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PART ONE

Computer Education: Update '83

by Edward Fiske

Like most public schools in the country, the Veterans' Elementary School in Provincetown, Massachusetts, is pressed for funds. Not long ago, though, a member of the economy-minded school board cornered Elliot Tocci, the school's principal, and asked him a startling question: "Do you have enough money budgeted for computers next year?" The incident indicates the dramatic changes that are now taking place in the role of computers in elementary and secondary schools across the country.

After nearly a decade of establishing beachheads and slowly consolidating their place in classrooms—largely through the efforts of teachers who happened to be computer nuts themselves—computers have in the last year or so suddenly come into their own. Sales of both hardware and software are soaring, and virtually every school in the country is wrestling with the meaning of "computer literacy." Students clamor for more time on the machines and teachers struggle to keep ahead of third- and fourth-graders who, after a week on an Apple II, always seem to end up knowing more than their instructors.

Computers are entering schools in record numbers and are forcing educators to rethink the teaching and learning process

Microcomputers have become the newest status symbols in American education. Principals boast about their technological acquisitions and compare notes on the subtle differences between various forms of hardware, and real-estate brokers report that potential home buyers now seem to be more interested in how many computers there are in the local schools than how many mills there are in the tax rate.

PTAs are holding rummage and bake sales to finance the purchase of computers. In Philadelphia, Grammy-award-winning jazz musician Grover Washington Jr. auctioned off the opportunity to play with his band on his next record album in order to buy a computer for his children's school.

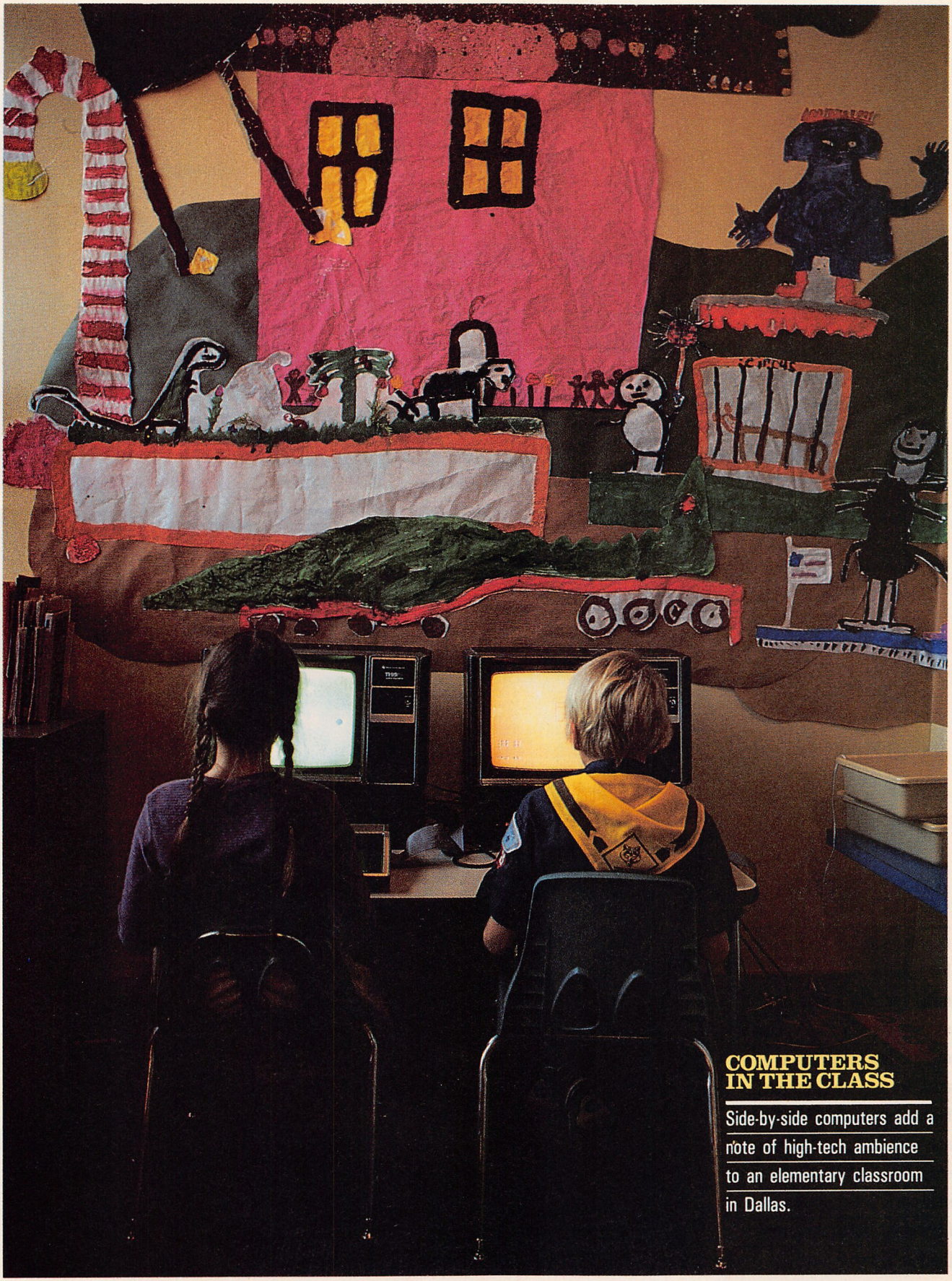
In one sense the computer fever that is now running through American education represents an acceleration of what has been going on for some time. The Chicago public schools have offered computer literacy courses for 18 years, and until recently the growth has been relatively consistent.

Changing Attitudes

In another sense, though, a major attitudinal change has taken place. Parents, teachers, administrators, school-board members, and others seem to have awakened suddenly to the fact that computers are becoming intrinsic not only to the job market but to every other part of American society as well. Because schools are supposed to train kids to move into the real world, it follows that they have a mandate to make sure that students are comfortable in using the new technology. "People have come to believe that kids simply have to know about computers," said Linda Roberts, an associate in the United States Department of Education who has surveyed the uses of computers across the country.

Frank B. Brouillet, the chief school official in the

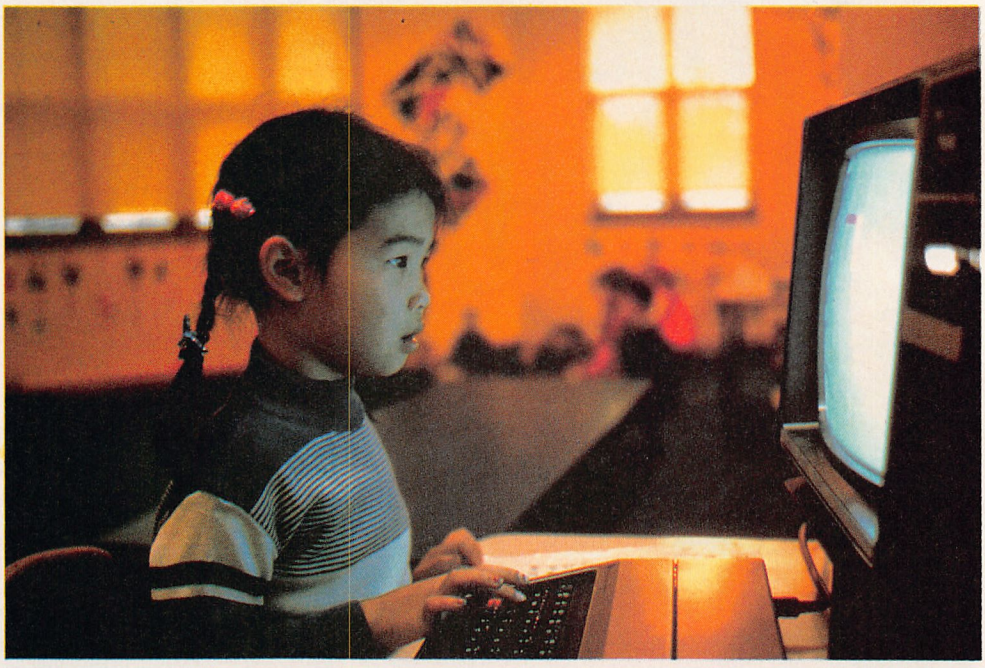
Edward Fiske is the education editor of *The New York Times*.



COMPUTERS IN THE CLASS

Side-by-side computers add a note of high-tech ambience to an elementary classroom in Dallas.

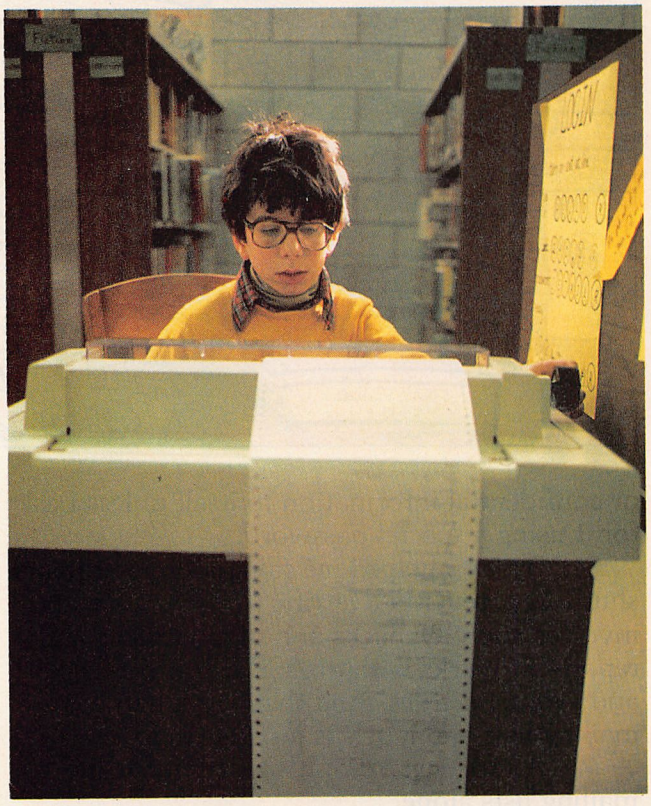
Photograph by Mark Perlstein/Black Star



AROUND THE COUNTRY

A preschooler in Dallas tries her hand at Logo (top). At a middle school in Palo Alto, a student explains the wonders of high technology to an audience of elders (bottom). Elementary students explore mathematics in a St. Louis school (top right). A solitary student in a school library, Lexington, Massachusetts (bottom right).

Photographs (Top), Mark Perlstein/Time Inc.; (Bottom), James Balog/Black Star



state of Washington, recently told an audience, "The information revolution has begun. No man, woman, or combination of individuals can stop it. Your own children and the children in your schools will either be the beneficiaries of this revolution or its victims." The new attitude is perhaps best summarized by a course offered to teachers by the Cupertino Union School District in California. It is entitled "Computers for the Absolute, Complete Beginner," and it is described as "a hands-on experience for computer novices who really don't like computers but feel they may be missing the crest of the wave."

The impact of the new attitude toward computers in American schools can be seen in the statistics. According to Market Data Retrieval Company, which surveys every school district in the country every summer, more than 23,000 of the 77,000 schools in the country had microcomputers in 1982. This represents 50 percent of all high schools, 40 percent of junior high schools, and 20 percent of elementary schools.

More striking than the overall totals, though, is the rate at which these numbers are growing. From 1981 to 1982 the number of schools with such technology rose by 33 percent among high schools and 48 percent among junior high schools. The number of elementary schools with computers nearly doubled—up by 85 percent.

The National Center of Education Statistics has identified several broad areas of computer use. It reported that one third of the 27,500 schools it surveyed in 1982 listed computer literacy as their principal objective. A quarter of the schools mentioned computer science per se, while one in five listed learning enrichment and instruction in basic skills as their goals. One in seven reported that they use microcomputers for compensatory and remedial instruction. Not surprisingly, high schools were more heavily into computer science and computer literacy programs while elementary schools were more likely to use their computers for compensatory and remedial work and for instruction in basic skills. The survey found that, in schools with microcomputers, students averaged about nine hours on the machines during 1982.

In 1981, Florida became the first state in the country to give computers in schools an official legislative blessing. Statute 229.8041 declares that "it is the policy of the state to use computers and related technology to make instruction and learning more effective and efficient and to make educational programs more relevant to contemporary society." A decade ago Minnesota established the Minnesota Educational Computing Consortium as a centralized system for computing and support services.

The Roles Computers Play

The ways in which schools approach computers are as varied as the communities they serve. The Veterans' Elementary School on Cape Cod is a good example of a school that is making the most of a

Photographs (Top), Tom Ebenhoh/Black Star; (Bottom), Bill Pierce/Time Inc.

Thank god

Business at Bundtweiller Brass Beds is booming! And now that Friday's here to help out, I've got everything under control.

Friday's the revolutionary new microcomputer information management system from Ashton-Tate, the people who invented dBASE II.™

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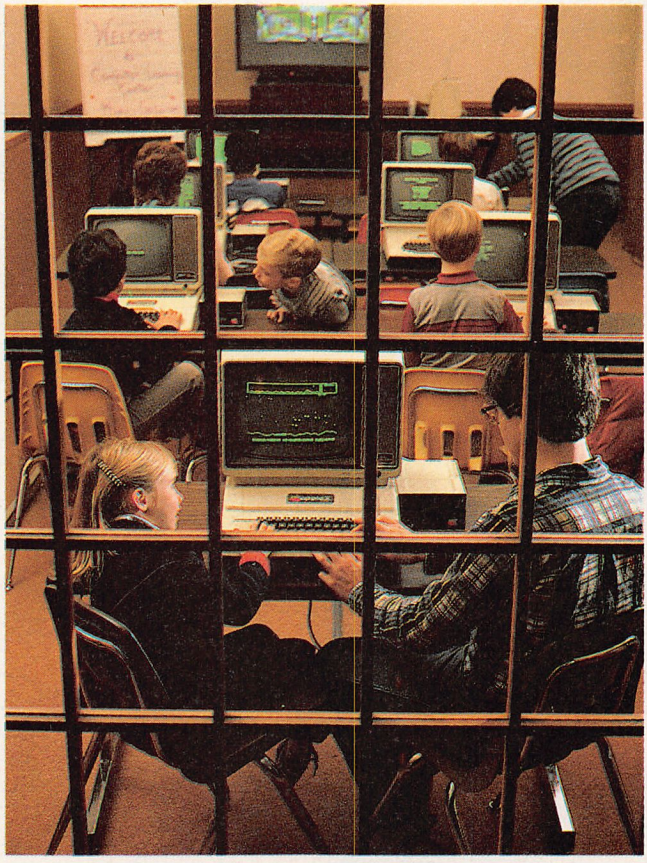
Circle 10 on inquiry card.

necessarily small investment. The school bought an Apple II last year, and, because no one knew how to use it, Elliot Tocci sent three teachers to Boston to attend a one-week computer course. They, in turn, are teaching the other 18 faculty members to use the machine. Each teacher gets a half hour of instruction followed by supervised practice and assignments while a substitute is hired to cover his or her classes.

The computer itself is moved from classroom to classroom, and by the end of last year it had been in each of the 10 classrooms for at least two weeks. Every child, including kindergartners, had a crack at some hands-on instruction, and soon even third-grade students were writing their own programs. Children can go to the library before and after school to use the machine, with help from the school librarian if requested.

Principal Tocci said that even his single overworked microcomputer has helped create a more exciting learning environment. Not only does it help make "abstract concepts concrete," he says, but it "often produces unexpected results that must be dealt with in new ways," thus bringing "an element of freshness and excitement and originality into the classroom."



LEARNING TO COMPUTE

Students of different ages learn together at a computer learning center in a Minneapolis suburb.

At the other end of the spectrum is the Houston Independent School District, which is running what may well be the most ambitious and innovative computer education program in the country. Billy R. Reagan, the general superintendent of the Houston schools, believes that computer literacy is joining the ranks of the three Rs. "We start by teaching kindergartners," he said. "In fact, we believe that in five years computer literacy will be second only to reading in elementary schools."

Under Reagan's guidance the 200,000-student Houston district has become the first urban school system to appoint a full-time associate superintendent for technology. Last year the Department of Technology, which has a budget of $4.2 million, installed 1500 computers in 200 of the district's 235 schools. So far one third of Houston's students have received some instruction from the 3000 teachers who have been trained to teach them, and there is a long waiting list of others who want to join in. "There was a little reluctance at first," reported Patricia Sturdivant, the new associate superintendent. "But I think most teachers are ready for the new technology. They don't want to be left behind their students."

Houston schools use computers for a variety of educational purposes. In an IBM-sponsored Right to Read program, students in three schools are taught to read by writing on terminals, and the district is about to launch a program in which non-English-speaking minority students will learn English from talking computers. The district's board of trustees has approved a plan to make computer literacy a graduation requirement. "This is the wave of the future," said Sturdivant. "We want our students to be able to survive out there in a world where technology will soon dominate. Everything is becoming so computerized, we think that unless you can relate in that language, you just won't be able to succeed."

Elsewhere, the use of computers has just about reached the point where, if you can think of a possible use of the machines for educational purposes, you can probably find someone doing it.

Relativity Made Relevant

At St. Anne's School in Brooklyn Heights, New York, for example, William R. Everdell teaches ninth-graders a course in the history of ideas. One of the twentieth-century ideas he likes to deal with is Einstein's theory of relativity, which asserts, among other things, that the mass of an object increases as its velocity approaches the speed of light. The famous formula, of course, is $E = mc^2$.

To get this concept across, Everdell designed a program called Einstein. Students begin by telling the computer their weight when they are standing on the scale, and then the computer asks, "What's your speed in MPH?" By putting in higher and higher

Photograph by David Burnett/Contact

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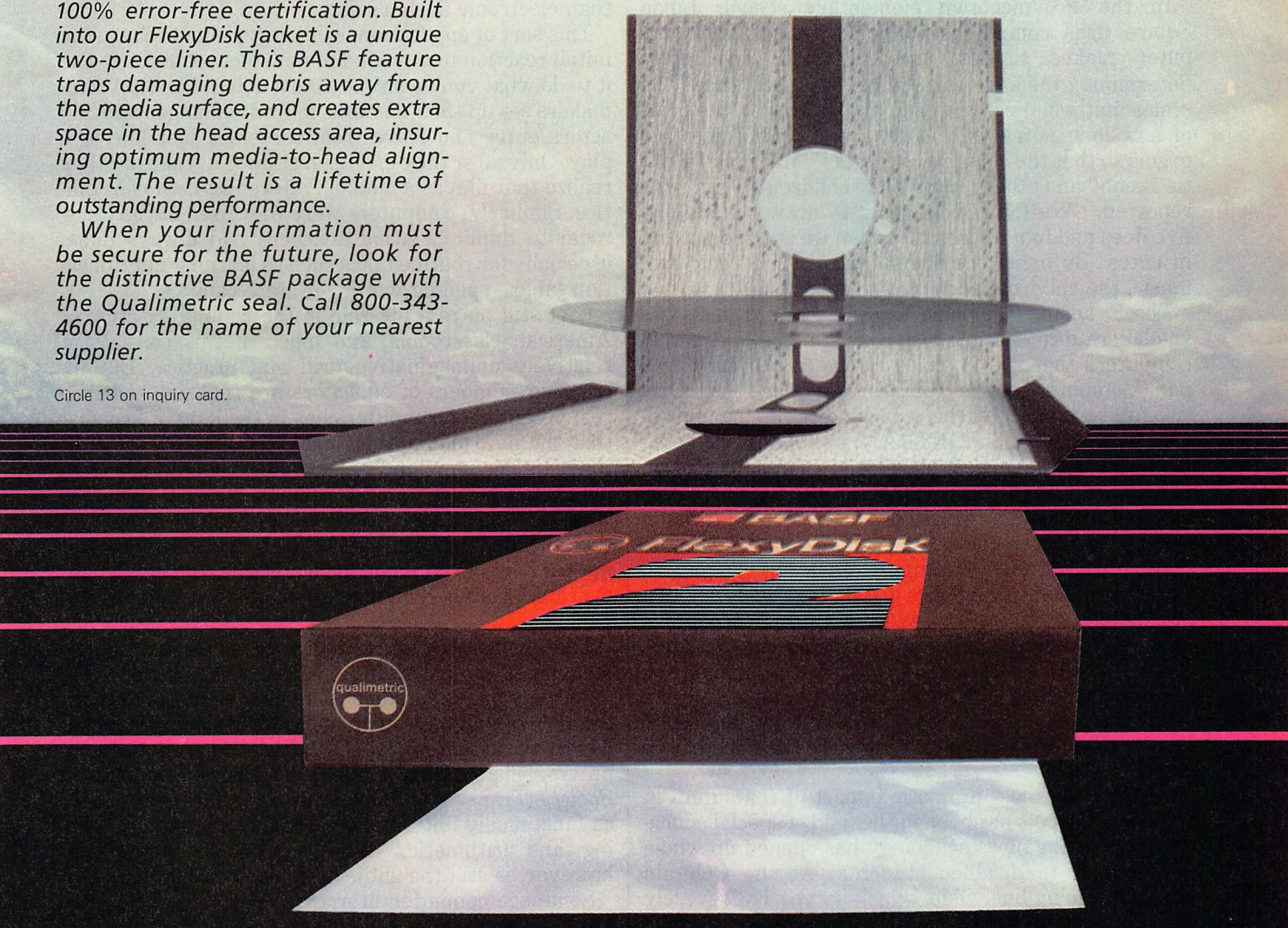

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speeds, students can find out how quickly their mass is increasing. For example, if a 165-pound student is moving at 100,000 MPH, the computer replies, "Sorry. You have gained. You now weigh 165.000002 pounds. If you go faster, your weight problem will get quite severe. Do you want to go faster?" At 1 MPH less than the speed of light, that same student's weight has soared to 4,087,096.15 pounds. If the student decides not to go any faster, the computer asks about the kind of fuel he or she was using, converts it into kilowatt-hours, and points out to the student that the energy just used on the hypothetical trip was "more than enough to run New York City for one year."

Everdell said that the program has served its purpose well. "They have all played with it," he said. "Now everybody seems to know what the special theory of relativity is about."

In the Provincetown elementary school, Linda Squire uses computers to teach music. The computer makes sounds, she explained, and, after determining the key of C, she has students "map" the scales mathematically, work out rhythms on the basis of how long notes will be held, and then write programs so that the computer will play "Mary Had a Little Lamb" and other songs. "The children love it!" she reported. "We figured out how to draw the staff of five lines and four spaces, and then we started putting in notes. By using the computer to write their own music, the children learn how to read it."

The Evanston Township High School in Illinois has an elaborate computer setup consisting of 25 Apple II computers that run in three rooms from 9 a.m. to 9 p.m. Computer science courses, which are taught by two full-time math teachers, include beginning and advanced BASIC and FORTRAN, and plans are being made for an advanced placement course in Pascal. Classroom use of the computers includes computer-assisted instruction in foreign languages and drills in reading and math classes, but this is only the beginning. Music students compose on their computers. Students in home economics use them to analyze diets, art students to work with graphics, vocational students to learn about banking and applying for a job. Even driver education is taught on computers. College-bound students at Evanston can take SAT and ACT study courses on computers and get diagnostic results that tell them the areas where they need more work.

Perhaps the most dramatic impact of computers in American schools has been in the field of special education, where the new technology has opened up whole new worlds to disabled students. At the Colerain School in Columbus, Ohio, which serves 113 severely physically handicapped children from 27 Ohio school districts, Melinda Peters teaches the use of computers to orthopedically impaired children and says there is a switch, gadget, or adapter for every impairment. One student uses a special switch in the form of a small square box on the backrest of his wheelchair. Others are able to execute their computer commands by using a thumb, a toe, or even an eye movement.

"The best part about the computer is that it is a fantastic motivator," said Peters. "Wheelchair-bound people in schools have to rely on others to care for them. But they can control the computer themselves, and there are precious few things in their lives they can control independently."

CAI vs. Computer Literacy

Defining the impact of computers on American schools is almost as complicated a task as categorizing the ways in which they are used. There was a time not too long ago when the big argument was CAI (computer-aided instruction) versus computer literacy. Plenty of schools still use computers as, in the words of Sydney Nolte of Texas Instruments, little more than electronic flash cards.

This sort of application is not surprising because the initial reaction to any kind of new technology is to use it to do what you've already been doing. The first filmmakers set up their cameras in front of stages and had actors enter and leave from the sides just like in a play. Only after they had been at it for a while did they realize that film as a medium offered its own possibilities. Similarly, computers were first used in the classroom to duplicate what teachers had always done, especially for routine tasks such as learning multiplication tables, spelling words, or state capitals.

CAI still plays a big role in the computerization of American classrooms, and much of this consists of relatively unimaginative drill and practice. But increasing numbers of educators are realizing that the real potential of computers lies in the kind of learning that the new medium has made possible for the first time. In this new kind of learning, students use computers to discover things for themselves, not to mirror what teachers have decided they should cram into their heads. As such applications become more and more a part of the academic landscape, the old debate over CAI versus computer literacy is becoming irrelevant.

The central argument today revolves around the meaning of computer literacy. There is general agreement on a vague notion that feeling comfortable with computers will be a fundamental skill for the technological world that is now emerging. "Ignorance of computers," claims Donald Michael, author of *The Future Society* (Transaction Books, 1970), "will render people as functionally illiterate as ignorance of reading, writing, and arithmetic." What this means in practice, however, is still the subject of considerable debate.

Some see computer literacy as revolving primarily around the student's ability to work the machine. "Computer literacy should involve development of skills that enable students to read, write, and work with the machines so that they can think and solve problems on their own," said Arthur Luehrmann, cofounder of Computer Literacy, an educational soft-

ware company based in Berkeley, California.

Others assert that hands-on expertise is a shortsighted goal and that without an understanding of social and technological aspects, tomorrow's citizens will be ill-equipped. "Somehow in education we've got to get below that opaque level of putting computers into the schools and teaching kids to run programs," said Ernest Anastasio, vice-president for research at Educational Testing Service. "We've got to teach them how the computer functions and what its potential applications are so they will have the knowledge to make intelligent choices later in their lives."

One school district that has taken a broad and systematic approach to the question of computer literacy is Chagrin Falls, a suburb of Cleveland that claims to be the first system in the country to require computer literacy. Ellen Richman, the school system's computer expert and author of the textbook *Spotlight on Computer Literacy* (Random House, 1982), says that the course required of seventh-graders covers three main areas:

- *How computers work:* Students examine chips, circuit boards, and other electronic components and take apart hand calculators, digital watches, and computer games to learn to identify their parts. They learn about the binary system and the flow of electricity through a computer circuit.
- *Computers in our lives:* Teachers explain the history of computers and how they are used in various industries and in homes. Community members are brought in to discuss the use of computers in their respective settings, and discussions are held on topics ranging from computer crime and privacy to careers in computer fields.
- *Programming:* Working at their own pace, all students learn to program. "We want students to feel a mastery," said Richman. "We want them to know that the computer is only a tool they can use."

Many schools include a unit on ethics in their computer literacy courses, and in some cases it's because of firsthand experience. At Evanston Township High School, a student once erased a program his teacher had put into the computer, and when the teacher called it up the screen displayed the single word "Ha." Jane Y. Rainville, the computer coordinator, explained that this led to the introduction of ethics into the school program. "We will treat the idea of destroying other people's property the same way it is treated in art classes," she said, adding that the school is also writing a plagiarism policy. "It's pretty easy now for a student to write an English theme on a word processor and give it to another student," she commented.

Computers Breed Changes

Schools that have made extensive use of computers—and an effort to go beyond drill-and-practice exercises—are finding that computers can significantly alter the way education takes place.

One obvious point is that computers are fun. Teachers routinely report that students line up before and after school and during recess periods to use the computers. Brett Wood, a 10-year-old student at William Monroe Trotter School in the Roxbury section of Boston, said that he prefers Apples to video games "because you can draw." He also mentioned that "in the arcades you waste your quarters."

By no means coincidentally, computers have the effect of encouraging experimentation—another quality that is all too rare in American classrooms. Elliot Tocci in Provincetown said that this is true because computers are "noncritical." They remove the fear of making mistakes, he observed, "freeing the child to take risks that he otherwise might be afraid to take."

Largely because they permit students to work at their own pace, computers in schools have the tendency to make distinctions such as grades and tracks within grades irrelevant. "With the computer in the classroom, you can expose each student to his or her own level of learning," said Houston's Sturdivant. "You can have particularly bright third-graders moving along faster than some eleventh-graders—and all in the same classroom." This, of course, has the added benefit of improving overall efficiency. "We no longer have to teach in the middle and hope that the bright kids aren't getting bored and the slow kids aren't getting behind," she added. "Now we let everyone go at his or her own pace."

Special education teachers say that computers have the advantage of being infinitely patient with slow learners, and those in inner-city schools add that minority students often respond more positively to computer-aided instruction than to traditional methods because they perceive the new technology to be "color-blind."

A Challenge for Teachers

Computers are also altering the student-teacher relationship in significant ways. One day recently Jo Irwin, teacher at Wainright Elementary School on the north side of Houston, stood watching in awe as 10 fourth-graders diligently plugged programs into microcomputers. "You know, a lot of these kids know more about these computers than I ever will," she commented. "It puts you at a little disadvantage, but I guess teaching is supposed to be a challenge."

Most educators are coming to agree that the challenge is learning to be a facilitator of the education process rather than the source of knowledge. "You just have to remember that you have the wisdom, experience, and judgment they don't have," said Rainville in Evanston. "They are faster and better than I will ever be, but I'm still guiding them toward their future growth." Barbara Mumma, a sixth-grade teacher at the C. B. Eaton Elementary School in

CONTINUED ON PAGE 142

Inside Apple

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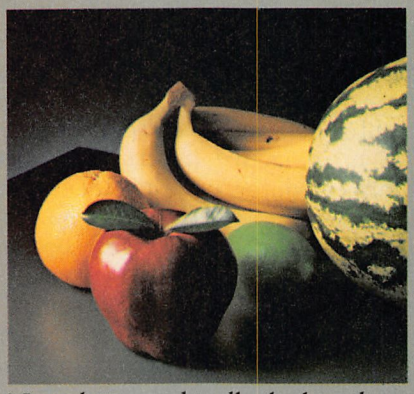

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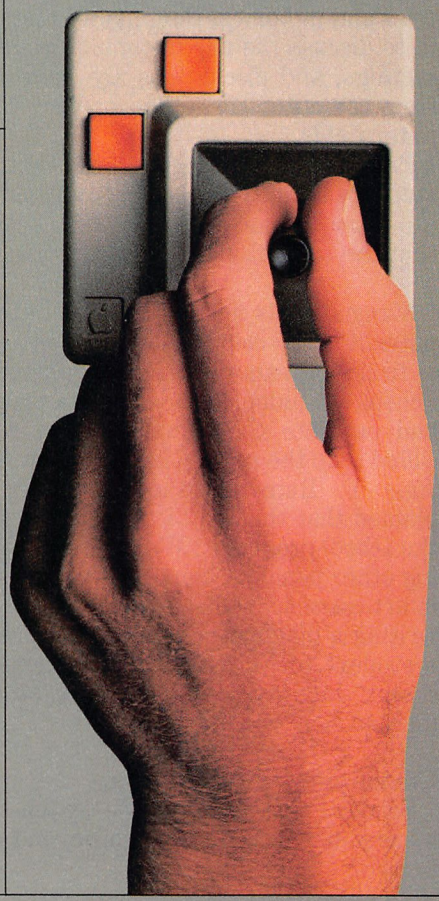

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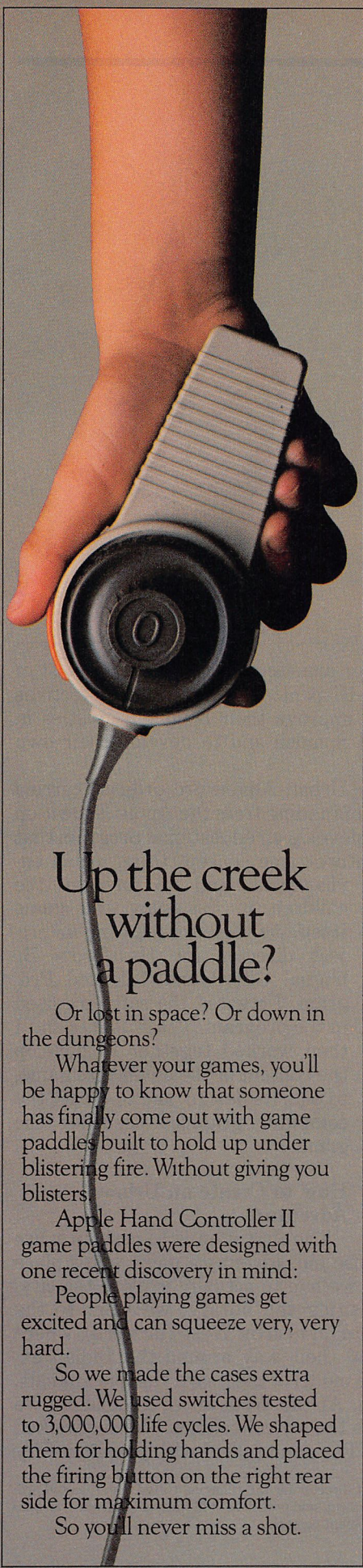

Up the creek without a paddle?

Or lost in space? Or down in the dungeons?

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So we made the cases extra rugged. We used switches tested to 3,000,000 life cycles. We shaped them for holding hands and placed the firing button on the right rear side for maximum comfort.

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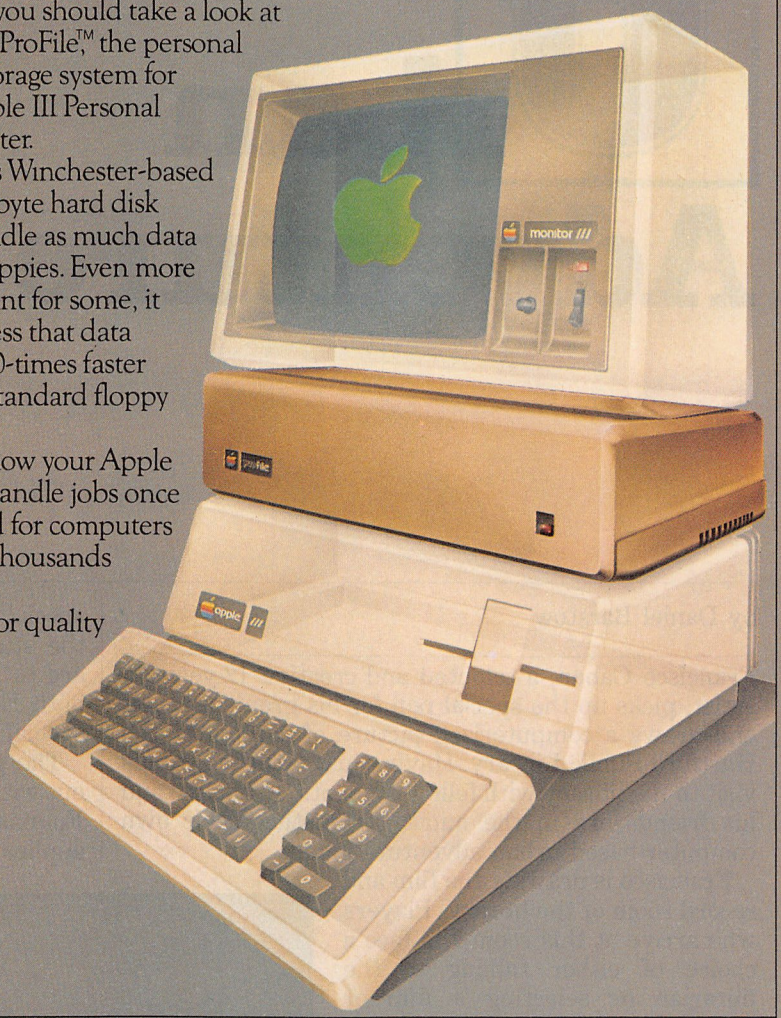

Launching pad for numeric data.

Good tidings for crunchers of numerous numbers:

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PART TWO

Urban Adventure

by Daniel Barstow

Francisco Caban, a talented and creative 12-year-old artist, picks up the special pen for his graphics tablet and draws a computerized picture of a room at the Hartford Public Library. Having just returned from a visit to the library with fellow students, Francisco and his friends are in the midst of creating their own computer-based urban adventure game.

Francisco is drawing the film and record room of the library. Players who arrive at this room will face a choice of either talking to the librarian or selecting a film or record directly from the stacks. If they go to the librarian, she will help them find what they want and answer some questions. If they go directly to the stacks, the films will fall down to the floor in a heap, and the player will be sent back to the library's main lobby.

Combining speech synthesis with graphics, this program shows how you can turn your own city into an adventure game

Urban Adventure takes place in Hartford, Connecticut. When the program is complete, players will be able to explore several locations in the city, such as the Wadsworth Atheneum (an art museum), Bushnell Park, and City Hall, as well as the public library. As they play the game they will learn about the city's educational resources and improve their map-reading, problem-solving, and language skills.

Lighting a Flame

Urban Adventure is a project of Encendiendo Una Llama (Lighting a Flame), a federally funded program that serves approximately 175 bilingual children in grades 3 through 6. All students in the program have special academic or artistic abilities. Because most of the students are Hispanic, the program's objectives are to help them improve their language abilities in both English and Spanish and to develop their own special talents.

The goal of the Urban Adventure project, carried out with the help of funding from the Apple Education Foundation, is to develop an educational program that applies the adventure-game concept to an urban environment and to involve the children in designing the game itself. As their teacher and as project director for Hartford's Bilingual Gifted and Talented Program, I created the software used in the program. The students and I then worked together to develop the content of the adventure game, to plan its design, and to create the computer graphics used for the game.

How to Create an Urban Adventure

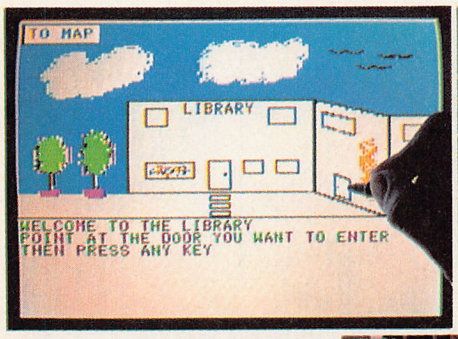
The first step is to conceptualize your game. Because our adventure game takes place in Hartford, first we had to actually explore the city. In addition to visiting the library, we went to the Children's Museum (in nearby West Hartford), where the children found their way around the Indian exhibit, a large-scale model of the heart, the live animals, and the aquarium. At the Wadsworth Atheneum, we wandered through the art collections. We also walked through Bushnell Park and talked with people in City

Daniel Barstow is project director for the Bilingual Gifted and Talented program in Hartford, Connecticut, and president of Metacomet Software, an educational software development company.

CREATING AN ADVENTURE

All it takes is some programming skill, a few creative kids with a city to explore, a bit of equipment, and lots of patience.

Photograph by Bill Buckley



OUTSIDE THE LIBRARY

A light pen is used to choose an entrance (top). Real-life adventurers (right) outside the Hartford Public Library.

Hall. Each area was ripe for creative adventuring.

When we returned to the school, we brainstormed about possible mini-adventures. We tried to figure out what the program should teach about each building and how we could also make it entertaining. Before we did any programming, we created the adventures on paper. To give some structure to the design process, we divided the paper into three parts. The top section was a pencil or crayon drawing of the room. The middle section presented the text describing the room. The bottom section of the paper listed the options available in the room.

After deciding which pictures to include in the adventure game, we worked on drawing them with a graphics tablet, which became an essential tool of the project. Using an Apple Graphics Tablet with its special pen, the children created computer images almost as easily as they draw with pencil and paper. Francisco, for example, who likes to draw in a variety of media, found the graphics tablet to be an enjoyable and creative tool for artistic expression.

The kids had fun thinking up ways to spice up the program. They wanted to draw piranha fish for the fish tank in the children's room.

The children also had fun thinking of interesting ways to spice up the program. The falling records in the film and record room is one example. The kids also wanted to draw dangerous piranha fish in the fish tank in the children's room, which would bite off the hands of game players who chose to touch them.

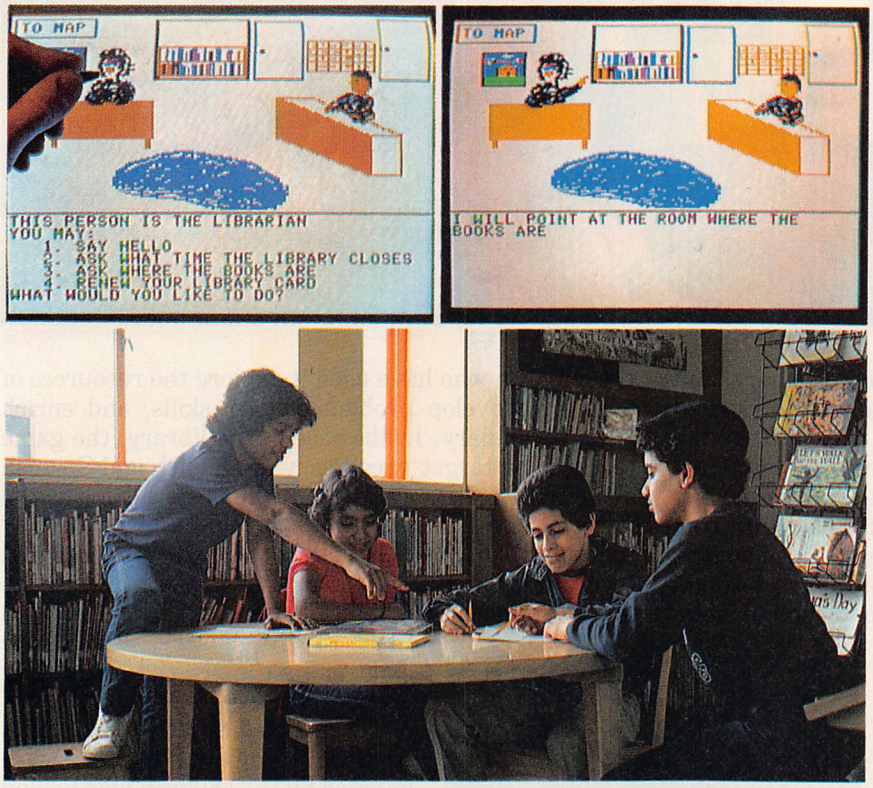
While the children were drawing the pictures and designing the adventure on paper, I worked on developing a macrostructure for the program. I had to design standard procedures for implementing the major features of the program and incorporate them in a model that we could adapt for each different building.

Writing the Program

Briefly, I developed a set of routines and subroutines to carry out activities such as displaying a map, picture, or text; recording a message; speaking a message; selecting an option; and changing location.

The most difficult part of writing a standard adventure game is getting the program to understand and respond to commands typed in by the user. These commands are usually entered as two words ("enter cave," "get axe") and are interpreted in the program by a two-word parser. The parser is a set of procedures that takes apart the two-word commands and cross-references the words with its dictionary of verbs and nouns. If both words are in the dictionary and the particular combination makes sense, the program takes the appropriate action. I found it hard to devise a parser that children can understand while they're working on developing a game.

Another problem inherent in the word-parsing type of adventure game is that it is sometimes difficult to figure out which particular word combinations to use. Second guessing the programmer's choice of words can be frustrating for children. In our case the parser was also a bad idea because we wanted to develop



GETTING TO THE CHILDREN'S ROOM

If you point the light pen at the librarian and ask her where to find some children's books (far left), she'll point out the door to the children's room (left). Adventure-makers (below) map out the children's room itself.

good language skills. "Go door" and "ir puerta" are not correct usage in either English or Spanish.

In our program we replaced the whole system of two-word commands with light-pen controls. A light pen is a computer accessory that is held in the hand like a pen and has a light-sensitive photocell in its tip. It can be pointed directly at any position on the screen, and the computer determines the x,y coordinates of the indicated position. Instead of entering written commands in our game, a user points the light pen directly at objects on the screen. Because the x,y coordinates of each object in the display have already been defined, the program "knows" where the user is pointing.

With the light pen, the children can trace their route on a map of Hartford displayed on the screen and find their way to particular buildings. When they stop at the library, for example, the map is replaced with a picture of the front of the library, showing two doors. A user points the light pen at the door he wants to enter. Inside the main lobby, he can point at the librarian, the card catalog, the book room, or doors to other rooms. Each choice leads to different actions, based on the program design.

One major advantage of this approach is that the light pen is natural for children to use. Because using the pen is intuitive, the game's emphasis shifts to exploring and learning rather than guessing words. The light pen also makes the game easier to program because it eliminates the need for complex word analysis. The program need only deal with the location of the light pen and the coordinates of objects in the display. Only one line (an IF/THEN statement) is necessary to direct program flow for each object in the display.

An additional benefit of the light pen is the supportive graphics software that comes with it. Gibson Labs, developer of the Pentrak Graphics System used in playing the game, has a powerful set of graphics commands that make it simple to write programs for the light pen. For example, the location of each object is set by defining the edges of an imaginary rectangle around the object. When the user points at the screen with the light pen, the program merely tests whether the specified point is within the bounds of any of the defined locations.

Instead of using the light pen, we could have used other graphics input devices, such as a joystick, paddles, keys, or even a mouse. We chose the light pen because we felt it was the most direct vehicle for this type of graphics adventure game and because we liked its graphics control facilities.

The Computer Speaks

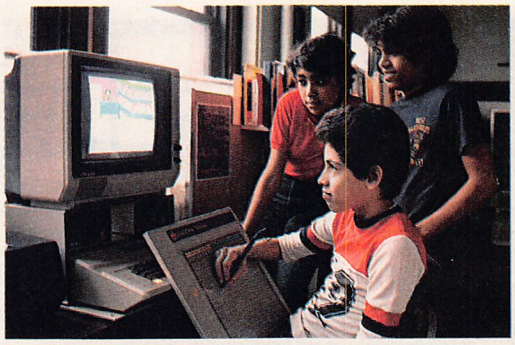
In the Urban Adventure game, certain phrases are spoken aloud in both English and Spanish so a user can learn the correct pronunciation of the target vocabulary. This is accomplished with the Mountain Computer Super-Talker, which is based on a direct recording process. With this device we can record selected messages as spoken by native speakers of English and Spanish and play the messages back as part of the program.

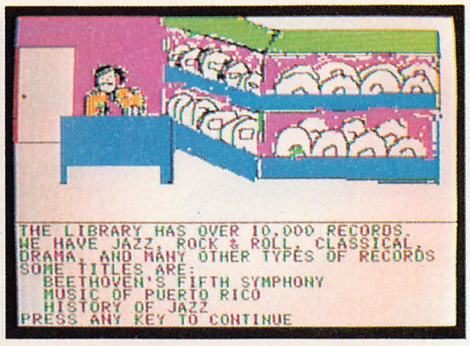
The Super-Talker consists of an interface card, a microphone, a speaker, and a disk. The system enables you to record your voice by digitizing sounds that you speak into the microphone. This means that the analog sound waves are converted to a digital code in memory, which is then stored in phrase tables on a disk. You can then play back the words or messages on request.

However, the price you pay for using a digitizing process is memory loss—the process uses memory quickly (up to 4096 bytes per second of speech). With the Super-Talker, the programmer needs to carefully

CREATING THE GRAPHICS

Francisco Caban uses a graphics tablet to draw the record room (right). The result, as seen in the game (far right), is shown just one moment before the records come falling down.





map out the contents of the Apple's memory and determine the maximum allowable length for stored phrases. Technically, programming this part of the adventure game was the most difficult.

Some other memory problems arose, such as the fact that the light pen and the Super-Talker had some conflicting demands on particular addresses in memory. Eventually we solved the memory problems through some swapping procedures and careful design of memory usage. Combining the light pen and the Super-Talker in the same program was not easy, however, and I don't recommend it for beginning programmers.

Your first step is to go exploring with your kids. Dream up some crazy adventures. Then start programming.

The Finished Product

Once we had a complete working program in English, we translated it to Spanish so we could have two versions. In addition to translating the text and recording the spoken messages in Spanish, we had to create a Spanish character set with a number of additional characters and accents. We used the Applesoft Tool Kit for this purpose. Because we wanted the use of each language to be as natural as possible, we did not translate each statement word for word. Rather, we translated the concepts from correct English into correct Spanish.

The Hartford Public Library, a prototype mini-adventure, is now complete. The rooms it displays are the main lobby, the children's room, and the film and record room. In addition to using light-pen input, the program also displays menus of options and lists of questions that a user can ask people in the display. Users can learn about the card catalog, about checking out books from the librarian, and about the films and records, the book shelves, the fish tank, and other people and objects in the library. Because we designed the program for specific local purposes, it is not being distributed commercially.

The Educational Benefits

Does the program achieve its educational objectives? Based on my observations, I find it has helped the children who have used it explore the resources of our city, develop problem-solving skills, and enrich their vocabulary. In the case of the library, the game teaches the target vocabulary in English and Spanish along with specific facts about the library (such as the name of the children's librarian and how to borrow films and records). Although the program does not teach children enough to survive on their own in the library, it could well be used as a springboard for field trips to the library, where the children can apply the skills they are learning.

The major educational benefits from our project, however, were enjoyed by the children who helped to *create* the program. They became experts about the Hartford Public Library and made dramatic gains in areas such as vocabulary (in both languages) and map reading. They also learned a good deal about working with computers and about planning and carrying out a complex educational activity. And it is this experience—kids and teachers working together to create an adventure game—that I recommend you try with your own children.

The possibilities for creating your own adventures are limitless. You can write an urban adventure that teaches about the resources in your own city or town. Or you could teach geography by writing an adventure that takes place in a different country. By drawing color pictures and inventing some wild creatures, you could create an imaginary adventure land. If you want to teach children about the human body, make a graphics adventure game to visually explore a computerized human body, with a heart that pumps and lungs that breathe.

The first step is to conceptualize. Before you touch the computer, go exploring with your children. Visit your city's or town's resources. Then brainstorm with the kids. Dream up some crazy adventures and work up some dramatic dialogues. When your adventure is all mapped out, fit the pieces into a model program like the one I've just described. I think you and the children will find the process to be extremely rewarding. □

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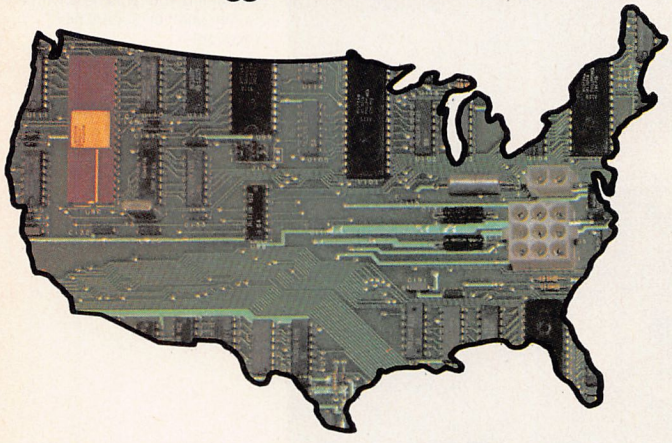

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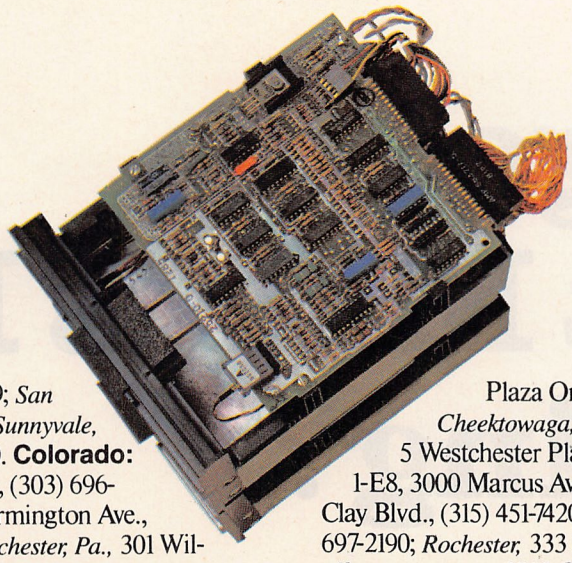

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PART THREE

Logo: What Makes It Exciting?

by Dan Watt

A guided tour of the educational language of the future, with a detailed review of the latest versions of Logo

In the world of programming languages Logo is the latest hit. With its ease of use, exciting applications, and educational benefits, Logo may someday replace BASIC as a universal first programming language. Logo's suitability for structured programming and modular problem solving may also lead to its use in introductory computer science courses, easing the transition to more complex languages such as Pascal and LISP.

This article presents a brief overview of Logo as a programming language, illustrating its potential for advanced as well as introductory programming. After describing the features of the language and giving examples of their use, I'll review the currently available implementations of Logo for the Apple II, the Texas Instruments 99/4A, and the TRS-80 Color Computer and preview some versions that are now becoming available for the Atari 400, 800, and 1200XL, the Commodore 64, and the IBM Personal Computer.

In this article you'll find a series of eight text boxes that illustrate aspects of Logo programming and elaborate on the brief descriptions given in the main text. While these are not designed to teach you how to program in Logo, they will give you a real sense of how Logo programming works. Because the later examples use ideas introduced in earlier ones, those unfamiliar with Logo should be careful to read them in order. Most of the illustrations have been adapted with the permission of the publisher from *Learning with Logo* (BYTE Books/McGraw-Hill, 1983).

The Power of Logo

Although Logo is a fairly new language for microcomputers, its development and use actually go back more than 15 years. Originally developed at Bolt, Beranek and Newman, a Cambridge, Massachusetts, high-technology consulting firm, Logo had been used in research laboratories around the world for a number of years before a microcomputer version became available. Many individuals influenced Logo's development, but Seymour Papert is most prominently recognized as its primary conceptualizer, developer, researcher, and public advocate. For many years Papert was director of MIT's Logo Group, and his research efforts during that time made Logo into a practical and effective educational vehicle. Also, Papert's influential *Mindstorms* (Basic Books, 1980) paved the way for Logo's growing acceptance among computer users all over the world.

Papert's philosophy of education combines the theories of Swiss psychologist Jean Piaget with programming approaches developed for research in artificial intelligence. Programming techniques such as recursion and list processing were derived from the artificial intelligence language LISP and have been integral to Logo since its conception.

Part of Logo's strength comes from the fact that it uses the computer as a control device. Logo users can control an external robot called a turtle, draw on a monitor with an on-screen turtle, create animated car-

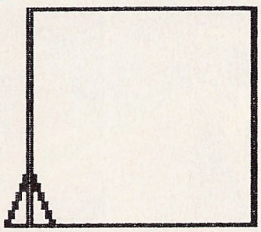
Dan Watt is a technical editor of *Popular Computing* and the author of *Learning with Logo* (BYTE Books/McGraw-Hill, 1983).

Illustration by Jeffrey Shrier

1 Building Turtle Designs with Procedures

The most common introductory Logo activity is creating designs with the turtle. At first this is done simply by typing a sequence of commands. To draw a square you could type these commands:

```
FORWARD 50
RIGHT 90
FORWARD 50
RIGHT 90
FORWARD 50
RIGHT 90
FORWARD 50
RIGHT 90
```



You can achieve the same result using the Logo command REPEAT, which needs two *inputs*: a number telling how many times to repeat something and a list of instructions to be repeated. Lists in Logo are always set off with square brackets.

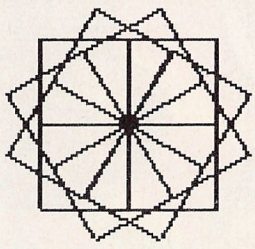
```
REPEAT 4 [FORWARD 50 RIGHT 90]
```

The power of programming in Logo comes when you teach the computer a new command, or more properly, procedure. For example, to teach the computer to draw a square, you define a new procedure called SQUARE. (The actual name is entirely arbitrary—you could call it BOX, R2D2, HENRY, or MOMMA if you like. The only name you cannot use is one that already identifies a built-in Logo command.)

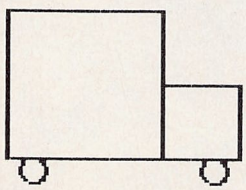
```
TO SQUARE
REPEAT 4 [FORWARD 50 RIGHT 90]
END
```

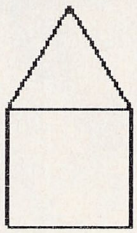
SQUARE is now a word in the computer's vocabulary. You can use it to teach the computer other words. FLOWER, for example, uses SQUARE as a subprocedure.

```
TO FLOWER
REPEAT 12 [SQUARE RIGHT 30]
END
```



SQUARE could also be combined with other shapes to make a truck, a house, or other designs based on squares.





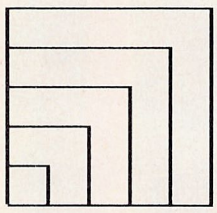
At this point you might be wondering whether you have to teach the computer a brand-new command every time you want it to draw a square of a different size. Actually all you have to do is modify the square procedure so that it can accept an input just as the Logo commands FORWARD, RIGHT, and REPEAT do. Modify the procedure as follows:

```
TO SQUARE :SIZE
REPEAT 4 [FORWARD :SIZE RIGHT 90]
END
```

SIZE is called a *variable*, and :SIZE tells the computer to use the current *value* of the variable named SIZE. If you designate :SIZE as 20, the computer draws a square with sides 20 turtle steps long. If :SIZE is 50, the square will be the same as our original fixed square, and so on. To specify a value for the variable SIZE, you type the command with an input number, as in SQUARE 20.

Suppose you wanted to make a set of nested squares as shown below. Simply type a series of SQUARE commands with different inputs.

```
TO GROWSQUARES
SQUARE 20
SQUARE 40
SQUARE 60
SQUARE 80
SQUARE 100
END
```



Logo does offer a simpler way to write procedures like GROWSQUARES; it's known as *recursion*—a process in which a procedure calls another version of itself. To establish this recursive process, GROWSQUARES needs an input that changes every time it calls another GROWSQUARES.

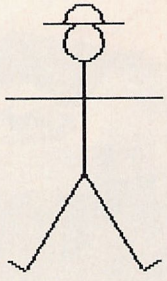
```
TO GROWSQUARES :SIZE
IF :SIZE > 100 STOP
SQUARE :SIZE
GROWSQUARES :SIZE + 20
END
```

When you give the command GROWSQUARES 20, GROWSQUARES checks to see if its input is larger than 100. If not, it goes on to the next step and calls on SQUARE, giving it an input of 20. Then it calls *another* GROWSQUARES but gives this one an input of 40 (:SIZE + 20). This new GROWSQUARES calls a SQUARE procedure with an input of 40 and then calls a new GROWSQUARES with an input of 60, and so on. Finally one GROWSQUARES procedure receives an input of 120 and the whole process stops. You'll find a more comprehensive explanation of recursion in "The Magic of Recursion" on page 156.

2 Subprocedures and Structured Programming

"Building Turtle Designs with Procedures" showed how subprocedures can be used to build designs from simple elements such as squares. You can also use subprocedures to create an overall plan for a project that can then be carried out by teaching the computer each subprocedure (one at a time). You can use this method to introduce even young children to a technique called *structured programming*, in which as many elements as possible are planned in advance and written into the main program before the subprocedures themselves are defined. For example, you can use the structured procedure PERSON to draw a stick figure:

```
TO PERSON
BODY
LEGS
ARMS
HEAD
HAT
END
```



A procedure like PERSON is sometimes called a *superprocedure*. Its primary function is to call the other procedures—BODY, LEGS, ARMS, and so on—that do the real work. Defining the procedure this way serves both as a plan for the entire project and as a way of dividing an otherwise complex project into manageable pieces. The subprocedures themselves can be made up of turtle commands and can even have subprocedures of their own. LEGS, for example, calls two subprocedures named LEFTLEG and RIGHTLEG, which are identical except that the angles are reversed.

toons, invent video games and interactive quizzes, or compose poetry and music. By making the action of the computer concrete, Logo builds a bridge between abstract reasoning and actual experience, thereby sidestepping many of the conceptual difficulties people have in learning to program a computer.

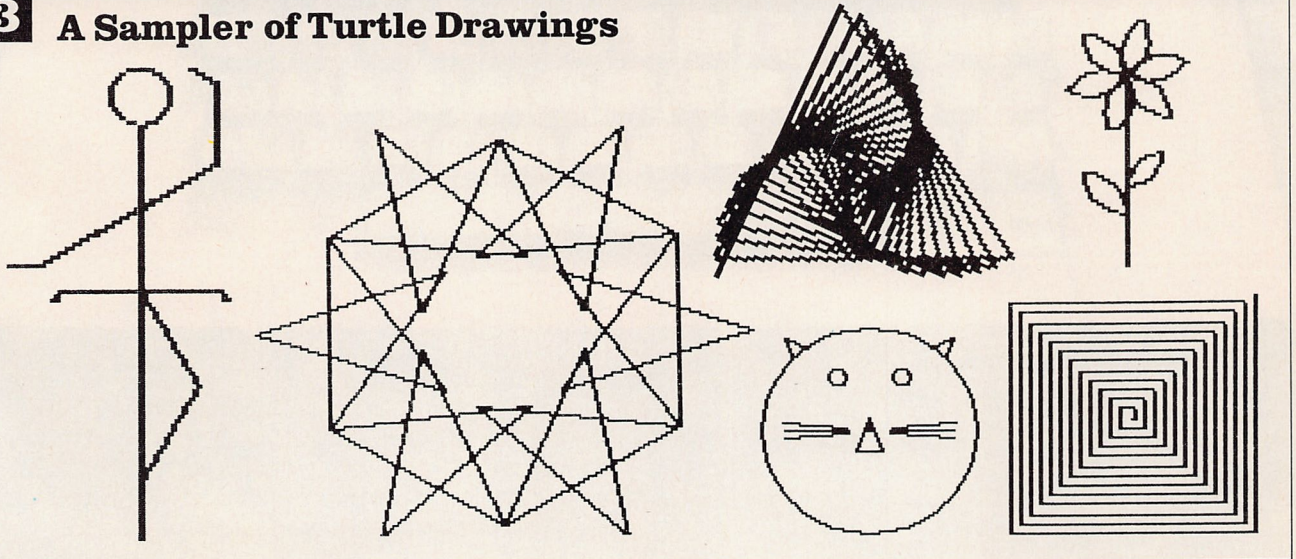
Enter the Turtle

The best-known Logo programming environment, *turtle geometry*, gives you a simulated turtle that is used as a sort of pen to draw on the computer's video-display screen. The turtle is controlled by simple commands like FORWARD, BACK, RIGHT, and LEFT. These commands can be used in combination to make the turtle create virtually any geometric shape.

To program in Logo you teach the computer new commands called *procedures*. To define a procedure you simply type the command TO followed by the name you choose for the new procedure. Once the procedure is defined, it becomes a new command in the language and can be used as a *subprocedure* to create other more complex procedures. Logo's ability to create complex geometric shapes from simple procedures makes turtle geometry a powerful tool for creating graphics with the computer and for learning geometry in a way that was never before possible. "Building Turtle Designs with Procedures" on page 108 shows how this is done.

Although turtle geometry seems simple at first glance, beginners of any age may find creating drawings quite challenging. To draw a stick figure of a person, as shown in "Subprocedures and Structured Programming," a learner encounters many of the key ideas in geometry, algebra, and general problem solving as well as important concepts of computer programming. Far from being limited to introductory activities, turtle graphics can incorporate the complex mathematical concepts of trigonometry, calculus, and

3 A Sampler of Turtle Drawings



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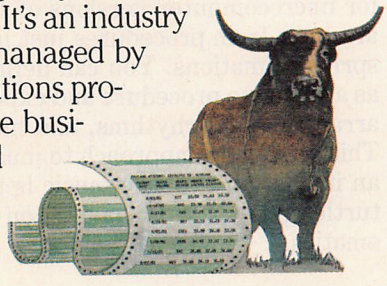

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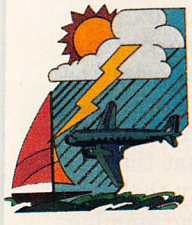

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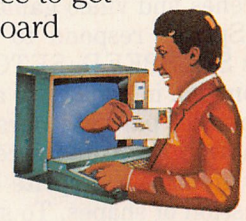

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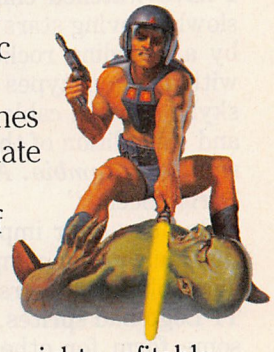

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topology. At least one college text on the subject has already been written: *Turtle Geometry*, by Harold Abelson and Andrea diSessa (MIT Press, 1981). See "A Sampler of Turtle Drawings" on page 109 for examples of turtle projects.

Zooming with Sprites

Another introductory Logo activity is programming with *sprites*—small, user-defined blocks that can be made to move rapidly across the screen. Sprites are like the turtle in that you can command them to move forward, back, right, or left. You can also give sprites certain speeds and make them zoom across the screen. They can take on different shapes and colors, and several sprites can appear on the screen at once. Just as the Logo turtle is a vehicle for creating geometric line drawings, sprites enable you to create animated scenes and video games.

Sprites respond to built-in Logo commands such as SETSPEED, SETCOLOR, and SETSHAPE. One common introductory activity with sprites is to create abstract patterns bursting with color and motion, as shown in "Sprite Procedures" on page 113. Another is to animate one sprite by making it go through a succession of shapes. To simulate a flying bird, for example, you create two shapes representing wings in different positions and then write a procedure that makes a moving sprite change repeatedly from one shape to another, giving the appearance of flapping.

Creating animated scenes with sprites gives full rein to a child's imagination and forges a strong link between that child's fantasy life and the power of a computer to make things happen. Some of the scenes that I have watched children create with sprites include slowly moving stars and planets in a black sky crossed by a speeding rocket or flying saucer, an aquarium with different types of plants and fish, a San Francisco skyline with a cable car and the Golden Gate Bridge, and a rendition of the takeoff and landing of the space shuttle *Columbia*. An example is shown above in "A Sprite Scene."

Because their implementation depends on capabilities built into a computer's hardware, sprites are not available for all versions of Logo. Until recently, only TI Logo had sprites, but soon they will be available in some form for other versions of Logo as well. See "Logo: At a Glance" on page 158 for more information.

Other Applications

Descriptions of Logo that stop with turtles and sprites are missing a lot of the action. Logo also includes commands that accept input from the keyboard or from game paddles or joysticks. These interactive programs range from simple quizzes to complicated action games that use sprites and turtles as players. For example, students in Logo classes have created interactive programs to play tick-tack-toe, race the turtle around a maze, or even practice arithmetic. (A simple interactive game is described in "GUESSNUMBER" on page 148.) Teachers have created interactive programs to help children learn Logo, and teachers of very young children have developed "Logo readiness" programs that allow preschoolers to control the turtle or sprites by pressing single keys instead of typing normal Logo commands. Similar projects have provided Logo programming experiences for students with severe physical handicaps.

Composing music is another Logo application that was developed at MIT and is now becoming available for microcomputer versions of Logo. Musical phrases are built from procedures just like turtle drawings or sprite animations. You can define each part of a tune as a separate procedure and experiment with different arrangements, rhythms, and harmonic combinations. This procedural approach to music could have as large an impact on the way music is taught and learned as turtle geometry is having on the study of mathematics.

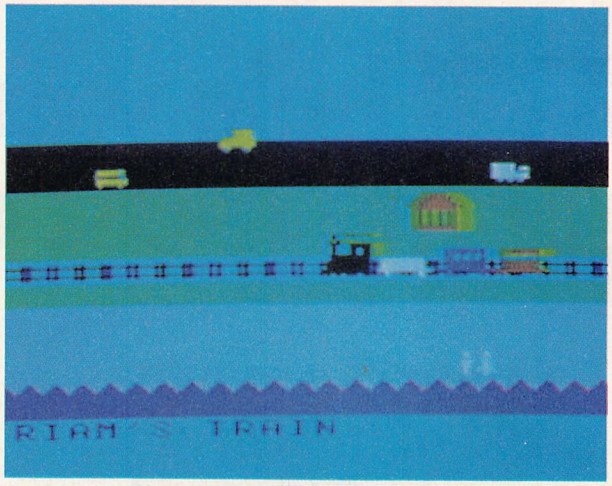
Data Processing with Lists

Logo's approach to processing data is based on the concept of a *list* as used in the earlier programming language LISP (an acronym for LISt Processing). Lists may be very simple or quite complex. The simplest list is made up of just numbers or words separated by spaces and enclosed in square brackets. For example, [THIS IS A SIMPLE LIST], [1 4 9 16 25], and [COOKIES CAKE [ICE CREAM] [HOT CHOCOLATE]] are all simple Logo lists. Notice that the last one contains other lists within it, a capability that sets lists apart from the strings used in other programming languages and allows them to be grouped hierarchically. This capability of Logo lists makes certain kinds of data processing quite simple. Examples of the uses of lists are given in "Building Sentences with Lists" on page 154.

CONTINUED ON PAGE 148

4 A Sprite Scene

This animated sprite scene was created by 9-year-old Miriam Lawlor. She used solid blocks of tile characters for the background.

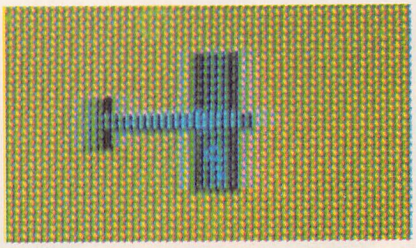


Photographs by Ed Crabtree

5 Sprite Procedures

Before you can give a sprite command, you must tell the computer which sprite you are directing. To make a sprite appear on the screen, you give it a position and a color and have it carry a shape. The following command sequence tells sprite 1 to carry a blue plane shape and move across the screen from left to right:

```
TELL SPRITE 1
CARRY :PLANE
SETCOLOR :BLUE
SXY 0 0
SETHEADING 90
SETSPEED 20
```



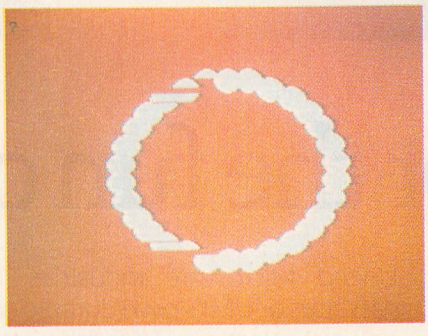
You can also use sprite commands in procedures. The following set of procedures makes a group of sprites repeatedly burst out in all directions from the center of the screen. These procedures take advantage of TI Logo's ability to command a group consisting of all 32 sprites and then have each of them do something slightly different.

```
TO STARBURST
SPREAD
BURST
EXPLODE
END

TO SPREAD
TELL :ALL
SETSPEED 0
SXY 0 0
EACH [SETHEADING YOURNUMBER * 12]
END

TO BURST
CARRY :BALL
SETCOLOR :WHITE
SETSPEED 50
END

TO EXPLODE
WAIT 100
HOME
EXPLODE
END
```



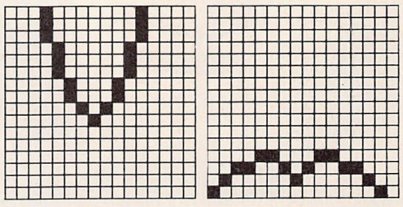
STARBURST is the superprocedure that calls the subprocedures SPREAD, BURST, and EXPLODE in turn. SPREAD makes all 32 sprites spread out in different directions on the screen. TELL :ALL, its first command, specifies that you are talking to all 32 sprites at once, and the next two lines set the sprites' speed to 0 and send them to the center of the screen. The EACH command in the last line lets you give a list of commands to each sprite in turn. In this case, [SETHEADING YOURNUMBER * 12] tells each sprite to set its heading to a value that depends on its number. Sprite 0 will have a heading of 0, sprite 1 a heading of 12, sprite 2 a heading of 24, and so on.

BURST gives the sprites a shape (ball) and color (white). At this point they all shoot out of the center in a splash of color. Now that they are all moving, the EXPLODE procedure uses recursion to create an infinite series of explosive bursts. The WAIT 100 command makes the computer wait a little while before doing anything else. Because the sprites were already moving, they just keep moving during this time. The HOME command sends them all back to the center of the screen at once. Then EXPLODE calls another version of itself, and the sequence repeats again, and again, and again. It looks great against a red background.

Flying Sprites!

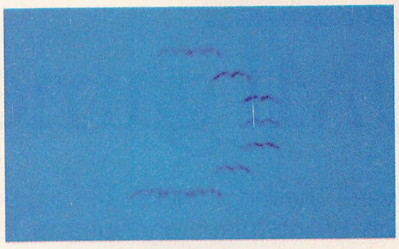
You can imitate the action of a flying bird by creating two sprite shapes, one representing a bird at the beginning of a flap and the other at the end of a flap. Call the first shape "WINGUP and the second "WINGDOWN. The FLAP procedure simulates a flapping motion by switching back and forth between the two shapes with a slight wait in between.

```
TO FLAP
CARRY :WINGUP
WAIT 10
CARRY :WINGDOWN
WAIT 10
FLAP
END
```



To make a sprite fly across the screen, give it a color, a heading, and a speed. FLY uses FLAP as a subprocedure.

```
TO FLY
TELL SPRITE 1
SETHEADING 45
SETSPEED 20
SETCOLOR :BLACK
FLAP
END
```



If you prefer, you can use SPREAD and BURST to get a whole flock of birds flapping across the screen in unison as shown in the photo above.

```
TO FLOCK
SPREAD
BURST
FLAP
END
```

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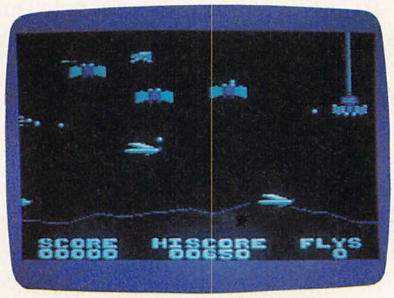

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VIDEO GAME ADD-ONS

Convert your game machine into a full-fledged home computer

by Jane Wollman

You can punch out Rocky in the ring, help Spiderman keep his web together, or blast junk food with toothpaste before your teeth rot. These high adventures—and more—are just a joystick away with this year's flood of video games coming to neighborhood stores.

Yet the biggest news in video games isn't the ever-expanding software lineup but the game systems themselves. They're metamorphosing into fancy entertainment centers—with high-resolution graphics, more realistic sound effects, synthesized speech, and innovative hand controls. What's more, with the introduction of new plug-in keyboard modules, games are adding home-computer capabilities. This means you can use the console not only to play Donkey Kong and Zaxxon but also to learn programming, manage your budget, and retrieve information from far-off data banks.

My First Computer snaps onto the Atari 2600.

The availability of low-cost computers that can run games as well as compute prompted game-machine makers to beef up their video systems to compete for sales. The result is a whole new generation of TV game machines laden with bells and whistles—and computing power.

Atari Leads the Way

The biggest video-game seller, Atari, was the first company to upgrade its line last year with its debut of the 5200 Advanced Game System, which sells for $199. The 5200 features detailed graphics, more authentic sound, and easier-to-use controllers than the original Atari 2600, which sells for $99. Soon you'll be able to connect a keyboard to the 5200, transforming the console into a home computer.

Already available is a similar module, My First Computer (less than $100), which snaps onto Atari's 2600 game machine. The add-on has 8K bytes of RAM (random-access memory), raised keys, and built-in BASIC. The module can also accept up to 32K bytes more memory as well as accessories like a printer and disk drive. The advantage is that now, in addition to running standard Atari games, the 2600 can use the new game cartridges with enhanced graphics and can run educational, home-management, and "personal development" software.

Jane Wollman is a freelance writer based in New York City.

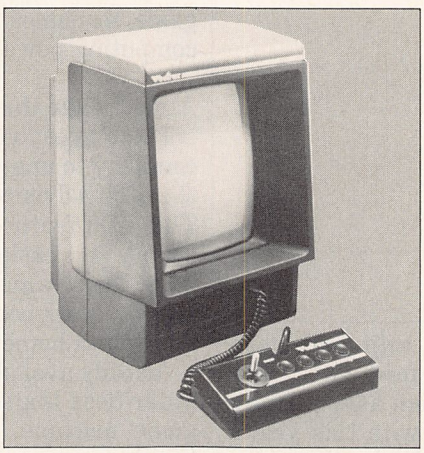
The Odyssey Command Center with built-in keyboard.

Mattel's Intellivision II and some of its add-ons.

Odyssey Upgraded

About 10 years ago, Magnavox brought out the first home video game, Odyssey. Now, North American Philips, its parent company, is offering the markedly more sophisticated Odyssey Command Center ($139 to $149) with a built-in typewriter-like keyboard. An optional voice accessory ($100) makes the unit "talk." Furthermore, if you connect a programming module ($100), the system becomes a computer. You can then attach a modem to send and receive electronic mail as well as retrieve information stored in central computers.

"Odyssey is first a game, then a terminal, then a computer," stresses Jerry Michaelson, marketing vice-president. "It's not a computer that plays games." The system's upgraded graphics are apparent in Smithereens, a medieval artillery battle. When played on the previous Odyssey 2, the game has no colorful background; on the Command Center, the game displays a range of scenic graphics like clouds floating over a grassy embankment.



Vectrex Arcade system.

Intellivision's Vision

The video-game company that whipped out the biggest bag of new tricks at the January 1983 Consumer Electronics Show in Las Vegas was Mattel Electronics. It introduced several systems: a new, lower-priced Intellivision, called Intellivision II, which is compatible with current cartridges; a highly advanced version, the Intellivision III; and an assortment of add-ons that turn what had been simply a video-game machine into—you guessed it—a home computer.

Intellivision II's new Master Component—more compact than the original and with improved controllers—is designed to sell for less than $200, compared to $200 to $230 for Intellivision. Also, a plug-in module, the System Changer (less than $100), lets you play all Atari 2600-compatible game cartridges on Intellivision II. (This attachment can also be used with the original Mattel console, although factory adjustment is required.)

To expand the system into a computer, an adapter (less than $150) connects to either Intellivision or Intellivision II. The adapter has 2K bytes of additional RAM for intricate computer-graphics manipulation and another 12K bytes of ROM (read-only memory), furnishing built-in BASIC. Included in the cost of the adapter is a typewriter-like keyboard. Apart from letting you use the system for computing, the keyboard helps vary game play by letting you change the graphics or skill level.

In addition, a program expander (less than $75)

The Colecovision system accepts plug-in modules.

The Ultravision self-contained game system.

snaps into the top of the computer, providing extended BASIC to create more sophisticated programs and to play complex games. Some of the new game cartridges can be modified. For example, in World Series Baseball, you, the team manager, can program in specific strategies for each player. Other extras include the Intellivoice speech module ($70 to $80), which hooks into the Master Component, and an organ-type keyboard for composing your own songs (less than $75).

Last but not least, Mattel has gone one more step to develop Intellivision III ($210). Scheduled for shipment in late summer or eary fall, the so-called fourth-generation game system moves on-screen figures twice as fast as Intellivision II does, features fine-resolution graphics that look similar to animation, and comes with two wireless joysticks. Other goodies are built-in speech synthesizers and jacks that let you run music and six-channel sound effects through your stereo system. New games will be introduced, but in the meantime you can play the current Intellivision software on this advanced system. And not surprisingly, all Intellivision II computer attachments work with the new system.

Coleco's Super Game

Another company offering a fourth-generation game is Coleco Industries. Stressing arcade action, Super Game Module 3 ($125) links with Colecovision's main unit ($170 to $190), adding over one million bits of information for lots of variation and remarkably detailed graphics. Using small wafers ($30 each) with eight times the memory of Colecovision's regular cartridges, the Super Game "comes so close to arcade action, you can't tell the difference," according to Bill Reid, a Coleco game evaluator.

Other Coleco plug-in modules include a steering wheel and gas pedal (less than $60) for racing games, a component (less than $60) that lets you run Atari game cartridges, and the Gemini Sound I speech module (about $80). The latter uses special tape recordings of game-character voices to instruct and comment on the proceedings. This attachment also works with Atari's 2600 system and with Coleco's new economy-model Gemini game (less than $100), which plays Atari-compatible cartridges exclusively. In June, Coleco introduced a computer module ($200 to $220) cum keyboard, along with a printer.

Self-Contained Systems

Yet another category of advanced video games has surfaced: the self-contained system. This type of unit comes with a built-in screen and does not need to be hooked to a television set. Ultravision ($999), for instance, combines a 10-inch color TV (which you can use for viewing broadcast and cable programs), a video-game system, and a 64K-byte home computer in one less-than-10-pound package. Ultravision comes with an attachable keyboard and includes simulated stereo and arcade-type screen effects such as three-dimensional rotation and zoom.

With an expansion module ($99), the portable system plays Atari and Coleco games; the computer side of its personality runs both CP/M and Applesoft programs.

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Mattel Electronics
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Hawthorne, CA 90250
(213) 978-5150

Coleco Industries
945 Asylum Ave.
Hartford, CT 06105
(203) 278-0280

North American Philips
POB 6950
Knoxville, TN 37914
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Ultravision Inc. plans to bring out an original line of applications software later this year. Add-ons, such as a modem, printer, disk drives, and headphones, are also on tap.

The other major self-contained system, unique in its own way, is the Vectrex Arcade (about $200). Applying vector-scan technology used in many arcade games, Vectrex Arcade has high-resolution graphics and a sound system with convenient features like volume control. The game's producer, General Consumer Electronics Inc., a subsidiary of Milton Bradley Company, claims Vectrex "so closely replicates" arcade action the system can "fully duplicate" games such as Space Wars, Berzerk, and Scramble. Optional plastic overlays placed on the 9-inch screen provide certain game information.

Vectrex also has "talking" cartridges (less than $40) that give voice to games without need to attach a separate speech module. And with a special light pen hooked up, kids can play games—like connect-the-dots—and learn music by drawing directly on the screen. Available next year will be touch-screen overlays and cartridges ($35 to $39), allowing game interaction simply by pressing a finger to the screen.

Like the others, the Vectrex game system can convert to a computer too. Set for retail rollout this fall are a full-stroke, add-on keyboard and six software packages. Next year, we'll see a word-processing accessory capable of generating an 8½- by 11-inch page of text.

Video games have indeed grown up since those early days of Pong and Haunted House back in the 1970s. In the interim, the machines have been credited with everything from corrupting the nation's youth to helping to rehabilitate the severely ill. Manufacturers say their new modular approach means video games will remain on the scene for some time and that more components will be added as technologies develop. Says one games executive, "If it improves game play and enhances computer power, we'll have it." □

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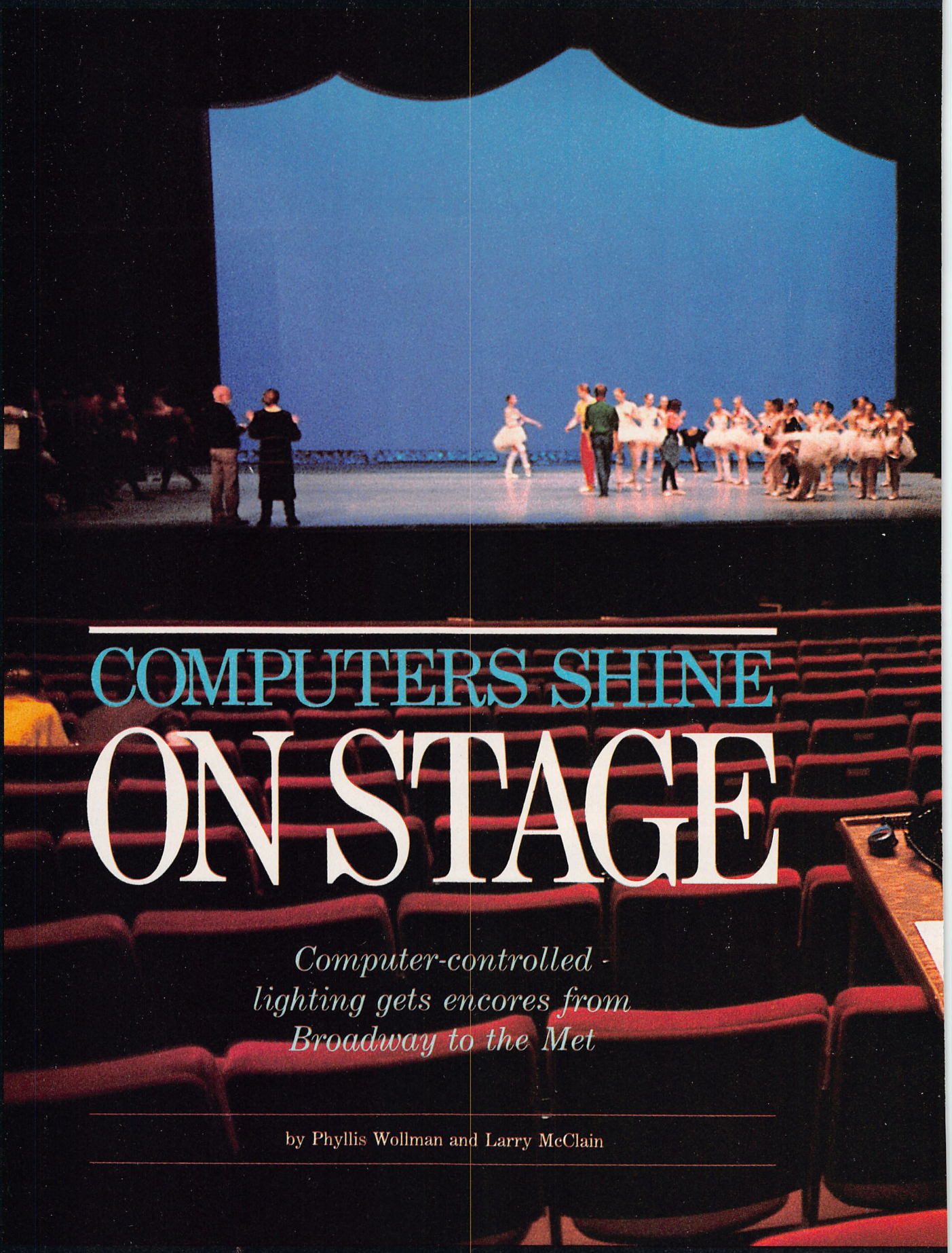
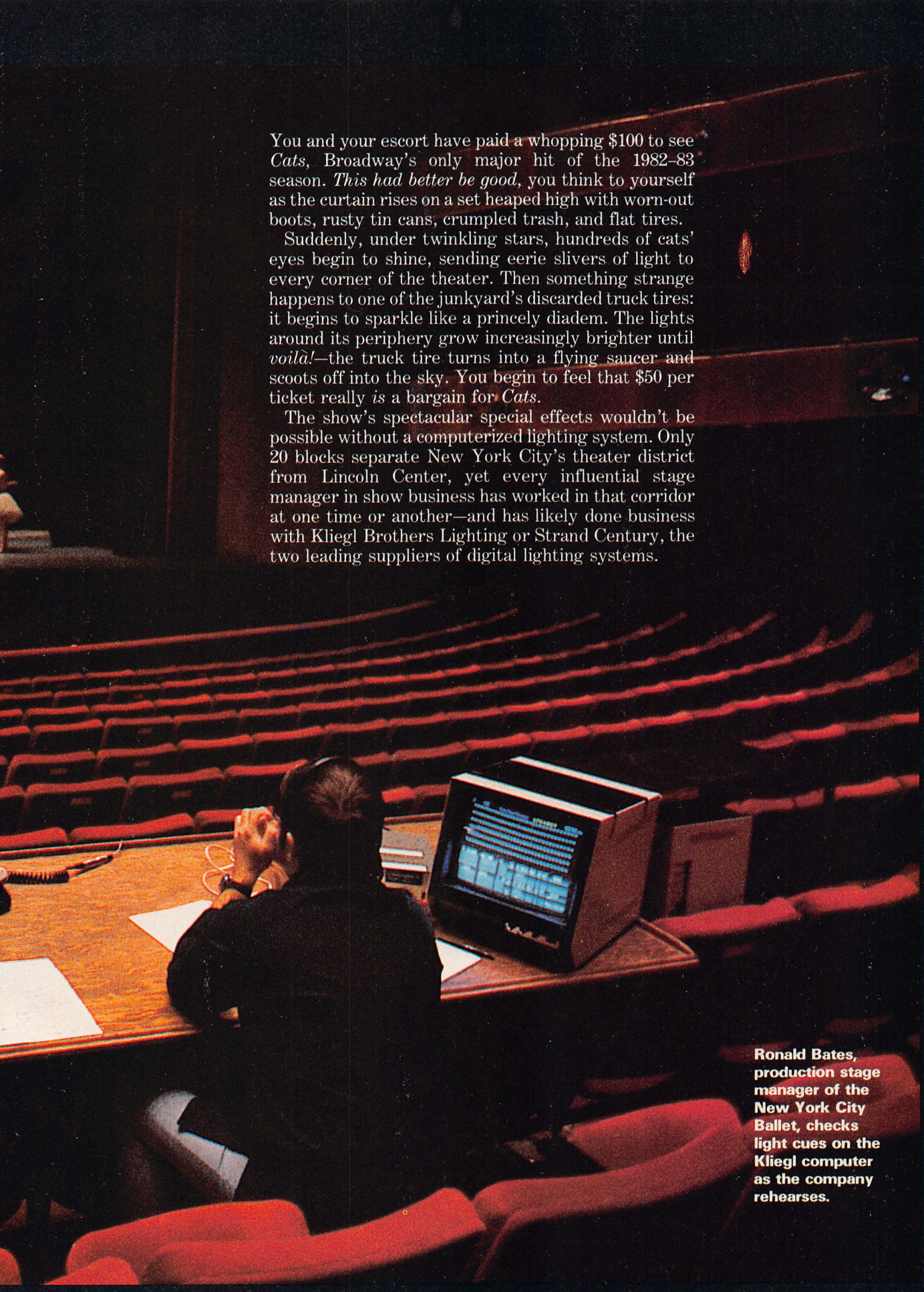


COMPUTERS SHINE ON STAGE

Computer-controlled lighting gets encores from Broadway to the Met

by Phyllis Wollman and Larry McClain



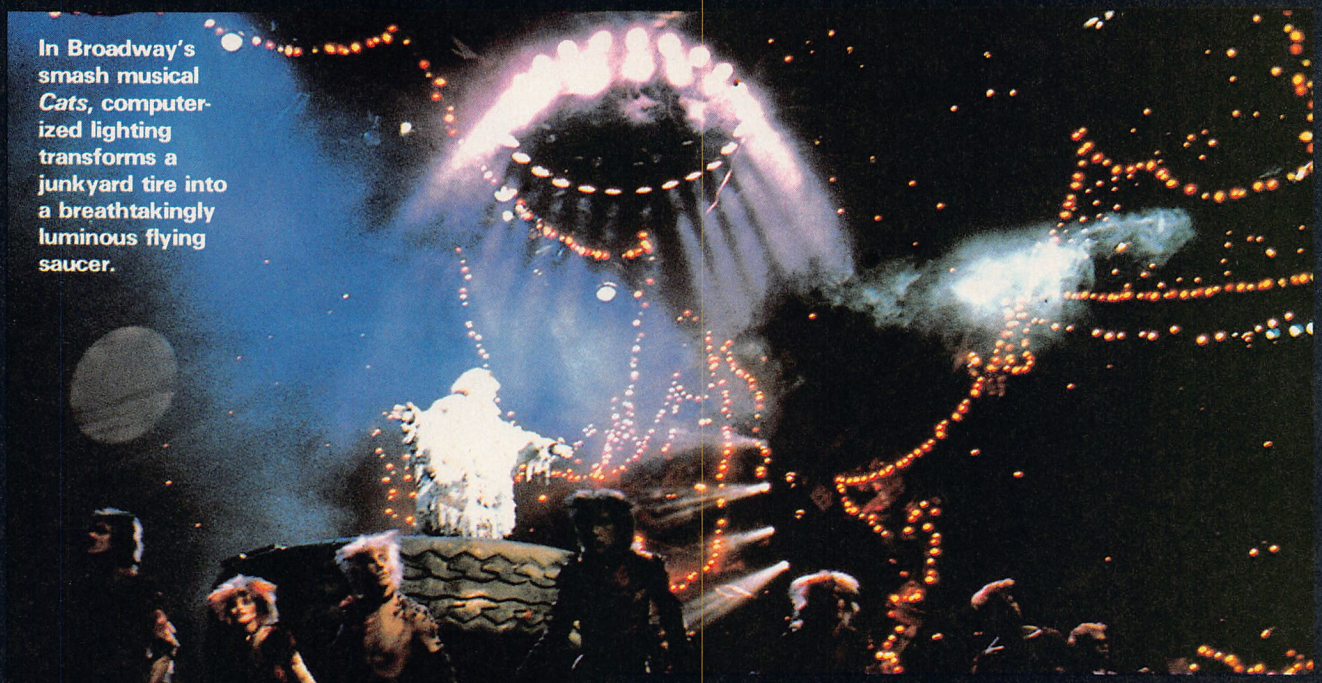
Steven Caras

You and your escort have paid a whopping $100 to see *Cats*, Broadway's only major hit of the 1982–83 season. *This had better be good*, you think to yourself as the curtain rises on a set heaped high with worn-out boots, rusty tin cans, crumpled trash, and flat tires.

Suddenly, under twinkling stars, hundreds of cats' eyes begin to shine, sending eerie slivers of light to every corner of the theater. Then something strange happens to one of the junkyard's discarded truck tires: it begins to sparkle like a princely diadem. The lights around its periphery grow increasingly brighter until *voilà!*—the truck tire turns into a flying saucer and scoots off into the sky. You begin to feel that $50 per ticket really *is* a bargain for *Cats*.

The show's spectacular special effects wouldn't be possible without a computerized lighting system. Only 20 blocks separate New York City's theater district from Lincoln Center, yet every influential stage manager in show business has worked in that corridor at one time or another—and has likely done business with Kliegl Brothers Lighting or Strand Century, the two leading suppliers of digital lighting systems.

Ronald Bates, production stage manager of the New York City Ballet, checks light cues on the Kliegl computer as the company rehearses.



In Broadway's smash musical *Cats*, computerized lighting transforms a junkyard tire into a breathtakingly luminous flying saucer.

With help from a Light Palette system, Tharon Musser won Tony awards for her lighting effects in *42nd Street* (below) and *Dream Girls* (right).

In the case of *Cats*, lighting consultant David Hersey used two Kliegl Performer II portable systems that store lighting cues in digital form on cassette. Hersey chose the portable consoles because the Winter Garden theater was too small to accommodate a lighting control booth. Hence, master electrician Jim Maloney Jr. sits backstage with the two Kliegl systems and watches *Cats* on a video monitor. Because the show's lighting is so complex, Maloney would always be a split second behind his cues were it not for the prompts he gets on the Kliegl units.

It took a long time for digital lighting systems to become the norm on Broadway, mainly because the top producers already owned expensive analog systems and were able to make money by renting this equipment to smaller production companies. The impresarios felt that any sizable investment in digital lighting systems would simply undercut their rental business.

DIGITAL DEBUT ON BROADWAY

Attitudes began to change in 1976, however, when computer-controlled lighting debuted on Broadway in a leggy hit called *A Chorus Line*. The show earned lighting director Tharon Musser a Tony award, and since that successful run she and her Strand Century Light Palette system have handled the lighting for other Broadway hits, including *42nd Street*, *Woman of the Year*, and *Dream Girls*.

Before the advent of computerized lighting, several electricians were needed just to work the dimmer boards, and lighting nuances changed from performance to performance based on the mood and stamina of the crew. Musser's approach, one shared by most of her colleagues, is to cue houselights and footlights with the computer while electricians manually operate the spotlights. She insists that lighting booths be placed in the back of the house even if they have to be at balcony level. From this vantage point, the master electrician watches the computer screen for cuing prompts as a fidgety stage manager looks over the electrician's shoulder and communicates via headset with the backstage crew members. Gels—the colored filters on the lights—are changed manually backstage during intermission.

Dream Girls, another Tony winner, owes much to Musser's lighting bravura. "The lights *are* the scenery in *Dream Girls*," she maintains. Indeed, lighting alone transforms a bare stage into settings as disparate as a sleazy Harlem theatre and a glittering Las Vegas showroom. To enhance the glitzy slendor of the Dream Girls' Vegas debut, Musser uses the Light Palette to make a 20- by 40-foot wall come to life with 800 brilliant-blue bulbs. But the pièce de résistance comes when the Light Palette operator transforms a fiberglass prop into a luminous staircase from which the Dream Girls belt a show-stopping tune.

These effects may look like a million, but *Dream Girls'* master electrician Jim Eisner insists they don't cost a million. Musser, he says, always tries to get maximum use out of a minimal lighting setup in order to reduce maintenance costs and problems.

"I work closely with Strand Century's programmers," Musser confirms. "We create programs that are effective but not outrageously expensive because most lighting directors work with tight budgets and I feel a responsibility to help develop things that are affordable to them too. After all, Strand Century's people are electronic geniuses—not theater people—so they can't be expected to think of all the things our industry wants. But they really listen."

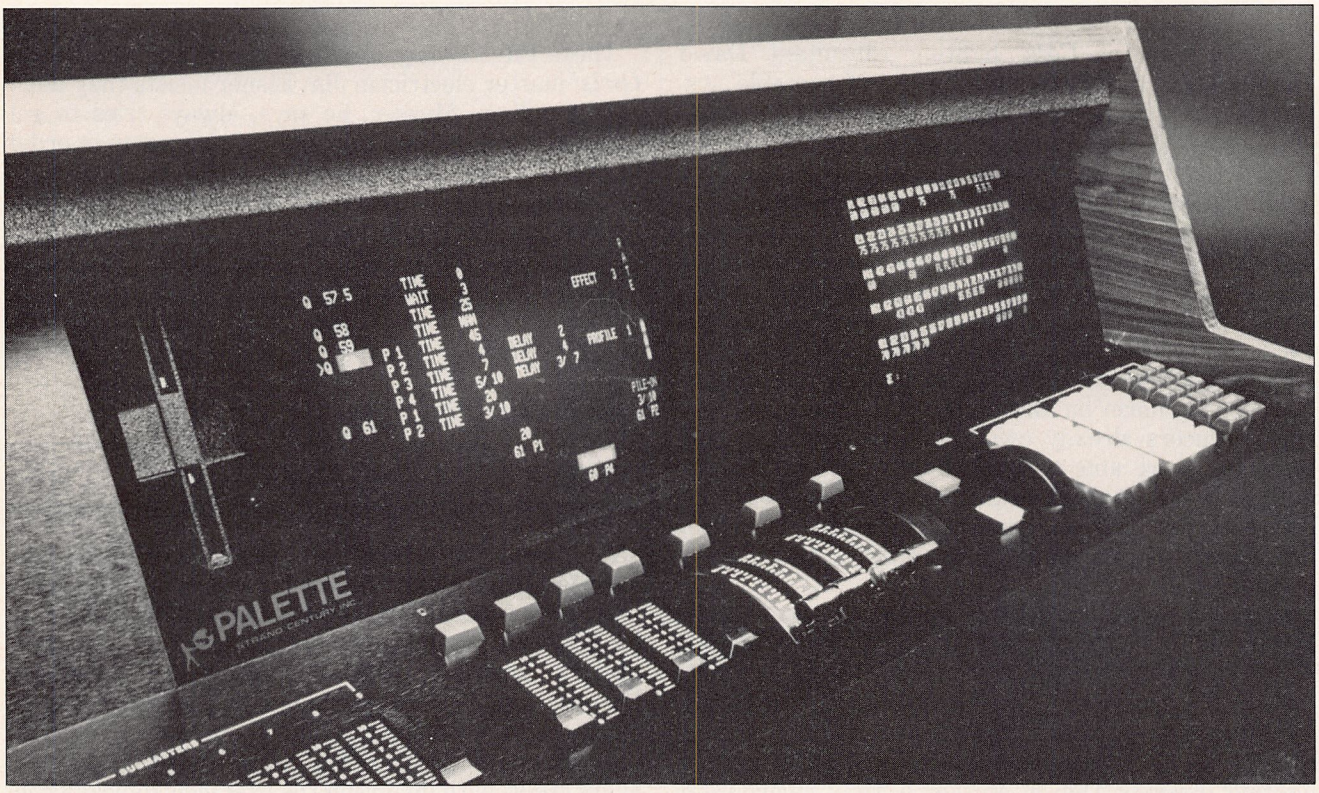
The managers of Spain's top bullfighting arena wanted a computerized lighting system to keep their matadors happy.

George Van Buren is the person most stage managers credit with inventing the first electronically controlled theatrical lighting system. In the early 1960s, the Los Angeles Civic Light Opera Company gave Van Buren the money to build a system controlling 48 dimmers. "It was essentially a brute-force solid-state system," Van Buren recalls. "Its memory consisted of potentiometers (which contain resistors) connected to each of the dimmers." His creation, which enabled each dimmer to "remember" 100 different lighting presets, soon became the workhorse of the theater business. "It was given the nickname 'Bessie Mae' by one of my female colleagues," chuckles Van Buren. "She told me, 'Anything that works that well *has* to be a female.' "

Bessie Mae was such an overnight sensation that Van Buren was soon fielding phone calls from several continents. Not to be outdone by the San Francisco Opera Company, the managers of Spain's top bullfighting arena ordered a Bessie Mae to keep their histrionic matadors happy. In the late '60s, Van Buren's company also began marketing lighting systems to touring rock groups.

Van Buren was the first lighting professional to take the minicomputer plunge. In 1972 he used a Digital Equipment Corporation PDP-11 to create a customized lighting system for the theater at the University of California–Los Angeles. Soon other Van Buren systems, patterned after his UCLA prototype, were installed throughout the world: in the Mormon Tabernacle in Salt Lake City, the Seattle Opera Company's auditorium, and the Polynesian Cultural Center in Hawaii. "They're all working to this day," Van Buren says with pride.

Photographs by Martha Swope



Strand Century's Light Palette—the first digital lighting system used on Broadway—made its debut in *A Chorus Line*.

Van Buren declined to get involved in the race to build a state-of-the-art microcomputer-controlled lighting system. He felt that the research and development costs would make for a razor-thin margin of profit, so he sold his company to Strand Century in 1976.

Van Buren is now chief engineer with the Holzmueller Company, a theatrical equipment rental firm in San Francisco. But that doesn't mean that this West Coast lighting legend is goofing off: there are still a host of nonlighting problems to address.

Command Performance's light cues can survive power blackouts. Unfortunately, the theater's spotlights cannot.

"In many good halls, a computer controls the rotation of the 35 to 40 acoustical reflectors (dishes) suspended from the ceiling," says Van Buren. "I've installed calibrated microphones that pick up the analog data—sound—and send it through an analog-to-digital converter and then to the computer. The height and angle of the dishes must change when certain variables do: type of music being played, number of empty seats, temperature, humidity—even the weight of clothing worn by people in the audience."

When the computer controls these acoustical dishes, the stage manager can rest assured that a mid-July presentation of *Carmen* won't be ruined by reflectors set for fur coats and tweeds. Van Buren knows that computer-adjusted acoustics are what separate an extraordinary concert hall from, well, a bullfighting arena.

A BYTE AT THE OPERA

A century ago, New York City's Metropolitan Opera House was located on 39th Street and illuminated by gaslight. In its new home at Lincoln Center, the Met employs a Strand Century Light Palette that lets a sole operator select from 33,000 lighting presets and store that information on cassette.

"The computer has made me more efficient, but it *hasn't* cut down on the huge number of hours I spend in the theater or my office," notes Gil Wechsler, the Met's lighting designer. That's because no amount of digitizing can ever remove the human element from opera. For example, says Wechsler, lighting cues are usually set at a dress rehearsal supervised by a famous conductor. It's not uncommon for the celebrity maestro to pass the baton to a colleague after the first few performances. That means many of the lighting cues stored in the computer must be edited when the new conductor takes over.

Another of Wechsler's headaches is finding electricians with lightning-quick reflexes; every opera has moments when the computer operator must watch the stage rather than blindly obey an on-screen lighting cue. Wechsler recalls an opera in which the leading

```
TO SQUIRAL :ANGLE :DISTANCE
 IF :DISTANCE > 200 THEN STOP
 FORWARD :DISTANCE
 RIGHT :ANGLE
 SQUIRAL :ANGLE :DISTANCE + 3
END
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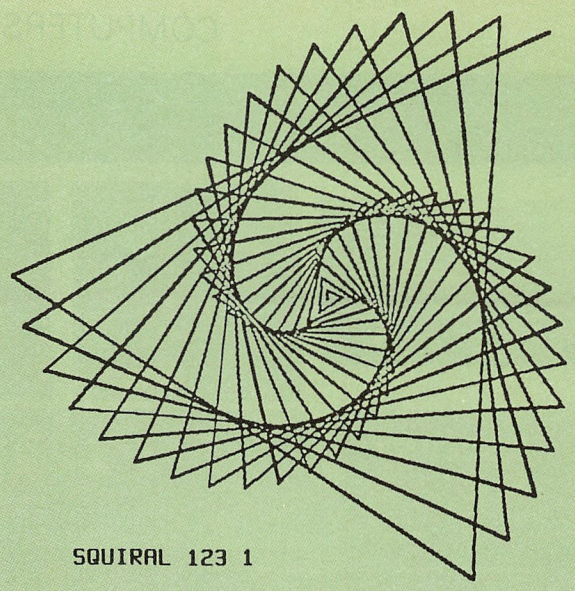

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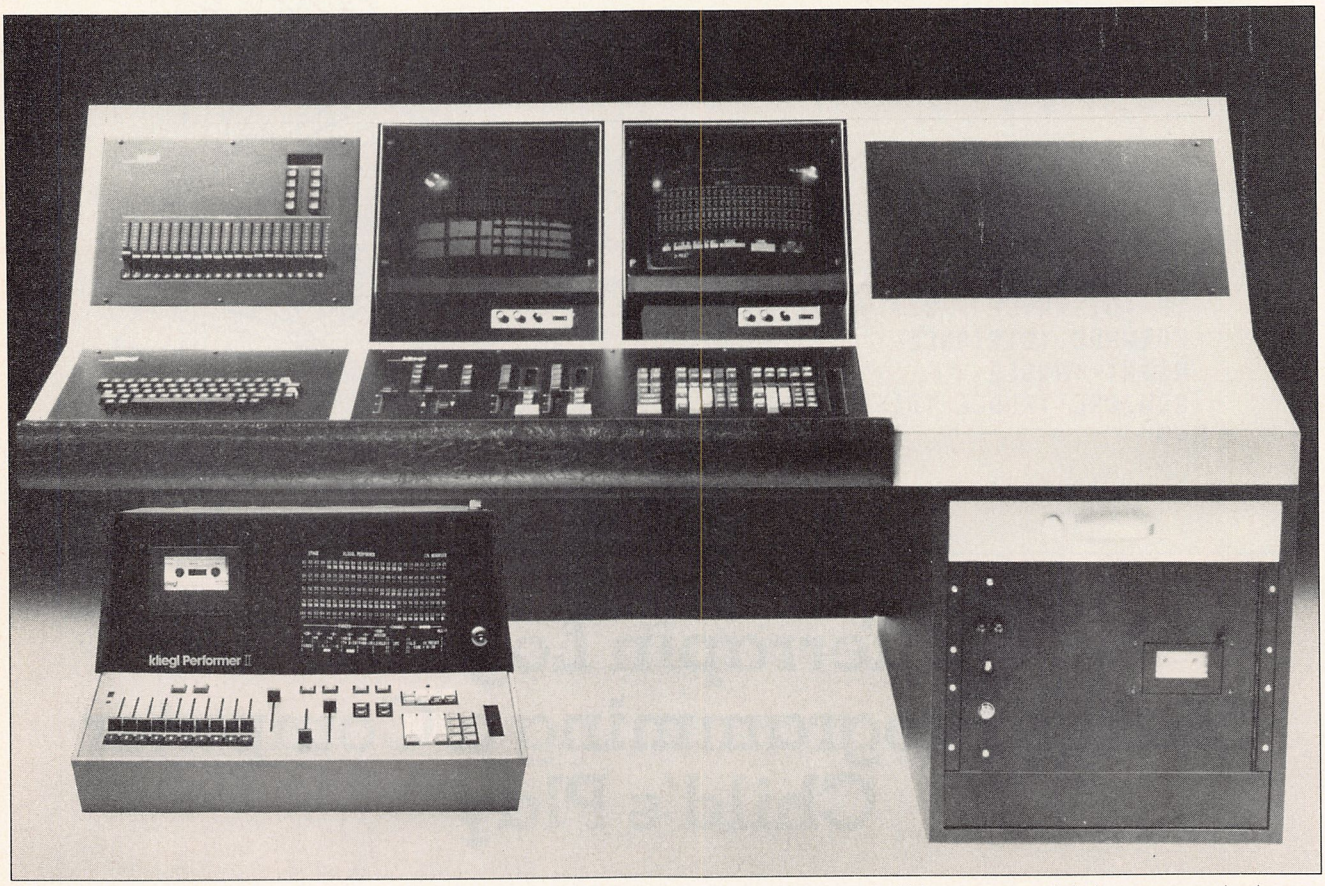

Lighting cues are safe in Kliegl's Command Performance and Performer II (inset), which have bubble memory and their own power backup.

soprano had to blow out six candles in a candelabrum, one by one. On the nights when the soprano had to take two breaths to blow out a candle, says Wechsler, the person at the Light Palette controls had to disregard the "Dim Candle 4" cue lest the scene turn inadvertently comical.

Wechsler once attended a Shakespearean play in which someone at the boards did grave injustice to the Bard. Throughout an entire scene, the lights shone on the side of the stage opposite where the actors were reciting their lines in darkness. What went wrong? Wechsler certainly isn't blaming the hardware: someone inserted the wrong floppy disk, that's all.

Another time, Wechsler supervised the lighting for a show in Japan and was shocked to discover that microcomputer-controlled lighting systems have not been a big hit in that nation of technophiles. That's because most Japanese stage electricians are men, and Japanese men are unaccustomed to typing—thus most of them lack the dexterity needed for quick editing of lighting cues on the computer keyboard.

THE BEAM ON BALLET

"Dancers are the most precise performers in the world," asserts Ronald Bates, production stage manager for the New York City Ballet, which stages its presentations at Lincoln Center's State Theater. "The computer is a fantastic tool because it allows greater speed in lighting cues. Without the Kliegl Command Performance, our ballet company would do less and do it less well."

Bates's relaxed Arkansas drawl is even more relaxed now that the State Theater has been renovated to make room for the digital lighting system. Command Performance has two screens: one usually shows diagrams of the light hookups; the other displays lighting cues during the performance. Bates has another confidence-booster in electrician George Maas, who takes advantage of the Kliegl system's COPEL (Command Performance Language) programming language to enter memos about last-minute cue changes. (Maas's little notes to himself appear in a special window on one of the two screens.)

Because Command Performance utilizes bubble memory *and* has a special backup system, the lighting cues will continue to run smoothly even in the event of a power blackout. There's only one catch, however: not one theater in New York City has a generator large enough to restore its lights should a blackout occur. Fail-safe, state-of-the-art lighting cues stored in computers don't do you much good when the theater goes pitch dark.

Well, that's showbiz! □

Phyllis Wollman is a freelance writer based in New York City. Larry McClain is a staff writer for *Popular Computing*.

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Transpak 2+	Transend 2	TransModem 1200 with serial interface and cable
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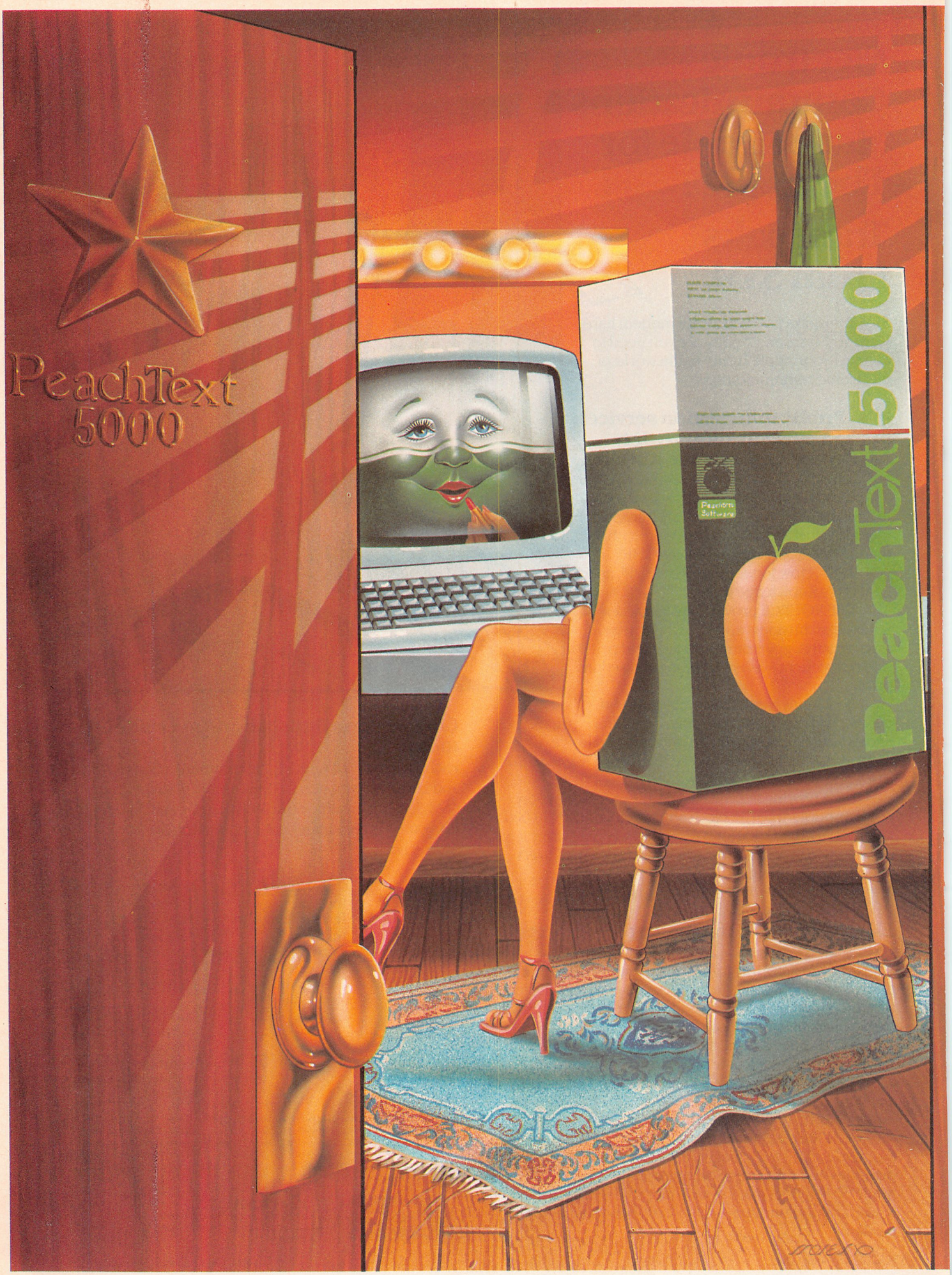
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PPC 883

The Sage II

A 16-bit computer that defines high performance

by Alan Freiden and Tom Woteki

With the advent of 16-bit microprocessors, personal computer performance has become a hot topic. But an advanced microprocessor does not necessarily guarantee spectacular performance—some 8-bit computers can actually outshine their bigger brothers on standard benchmark tests. To clarify this issue, and to show you what a 16-bit computer can really do, we'll give you a guided tour of the Sage II, a Motorola 68000-based machine that offers demanding scientific and business users more computing power than we've seen in any other personal computer.

To highlight the Sage's performance, we'll be comparing it with the now familiar IBM Personal Computer. Bear in mind that we're looking at hardware only—no one can deny that IBM has produced a fine machine or that the support and software availability the firm is famous for are important. But the comparison will reveal how the potential of 16-bit microcomputers is just beginning to be realized.

The Sage II is a computer in a box. It contains no keyboard or display—you must add a separate video-display terminal. In the box, however, you'll find:

- a Motorola 68000 microprocessor
- 128K to 512K bytes of random-access memory (RAM)
- one or two floppy-disk drives (640K bytes of storage per drive)
- two high-speed serial input/output ports (one for a terminal, the other for a modem)
- a Centronics-compatible parallel printer port
- an IEEE-488 bus controller circuit
- a real-time clock
- a built-in cooling fan
- a 50-watt switching power supply

All this is packed into a metal case that measures 5½ by 12½ by 16¾ inches and weighs 18 pounds. So why didn't the manufacturer put a handle on it and call it a portable? Good idea, except that the display and keyboard would be added to the bulk. And don't forget the manuals; Sage provides a massive amount of documentation with a capital D. A company promotional brochure claims the documentation tells you "more than you want to know about a computer."

The Sage II comes with the UCSD (University of California, San Diego) p-System—a $1400 operating system that gives the computer some rather unusual features we'll discuss later on.

Measuring Computing Power

Computing power is based on four key attributes: size of data items, microprocessor speed, memory capacity, and mass storage capacity. The first three depend largely on the microprocessor that controls the computer.

Data item size is measured in bits. A bit, the smallest unit of information inside a computer, represents a 0 or a 1. The Sage II uses the Motorola 68000, a 16-bit microprocessor. It processes data in 16-bit units, both in its own registers and during input and output from memory or other devices. Eight-bit microprocessors can input and output data only 8 bits at a time. Reading a 16-bit number from memory requires just one step in a true 16-bit unit, for example, but the same operation takes two steps in an 8-bit computer. In many applications, this difference in data item size gives the 16-bit microprocessor a big advantage in computation time.

The IBM Personal Computer uses the Intel 8088, which is really only a pseudo-16-bit microprocessor. It is capable of operating on 16-bit chunks of data inside its own registers, but in communications with memory and external devices it must use an 8-bit data bus. As a result, it has only some 16-bit advantages. The same holds true for the Compaq, the TI Professional Computer, and other IBM-compatibles based on the Intel 8088.

Microprocessor speed is the next key factor in computing power. Here we are dealing in the seemingly insignificant units of

Alan Freiden and Tom Woteki are principals of a software development firm in Washington, D.C.

At a Glance

Name: Sage II

Uses
Personal computing in demanding scientific, engineering, and business environments

Manufacturer
Sage Computer Technology
4905 Energy Way
Reno, NV 89502
(702) 322-6868

Standard Features
16-bit Motorola 68000 microprocessor, 128K to 512K bytes of random-access memory (RAM) with parity checking, one or two 640K-byte floppy-disk drives, two serial I/O ports, Centronics-compatible parallel port, IEEE bus controller port, real-time clock, UCSD p-System

Base List Price
$3600 for 128K bytes of RAM and one 640K-byte floppy-disk drive

Typical System Price
$4705 including Liberty Electronics Freedom 100 terminal, Okidata Microline 80-column printer, and cables

Documentation
240-page owner manual, 1200-page UCSD p-System manual, 300-page introduction to UCSD Pascal, applications catalog

Options
Upgrade to multiuser Sage IV with up to 1 megabyte of RAM and up to 30 megabytes of hard-disk storage

The Sage II computer and disk system (top) and Televideo 925 terminal (bottom).

time—millionths of a second—needed to accomplish rudimentary machine operations such as adding the contents of two registers. But the effects of microprocessor speed are indeed significant in applications that require millions of operations to complete a single useful function. Animated graphics, multitasking (sharing time between several users or programs), process control, and scientific problems are all applications in which microprocessor speed can be a crucial factor. In uses such as data entry or word processing when the computer spends most of its time waiting for user keystrokes, though, the microprocessor's speed is not all that important.

The microprocessor speed of the Sage II is approximately 2 million instructions per second, based on a clock circuit that ticks 8 million times per second. Most other personal computers can process no more than 1 million instructions per second, with clocks running at 4 million times per second or less.

Twice as many bits per data item, twice as many instructions executed per second—simple deduction says the Sage should be four times faster than other personal computers. That's not a bad estimate. We ran several popular benchmark programs on the Sage II and compared the results with those of other microcomputers. We found a 3.5-to-1 speed advantage for the Sage II over the IBM Personal Computer and a 7-to-1 advantage over the Apple IIe. (See "A High-Level Language Benchmark," September 1981 BYTE, page 180, and "Eratosthenes Revisited," January 1983 BYTE, page 283, for details on the benchmark programs.)

Memory capacity, meaning random-access memory (RAM), assumes varying degrees of importance in measuring computing power depending on what you're trying to accomplish. Uses like modeling, sorting, database searching, detailed high-speed graphics, and complex spreadsheet work require that large amounts of information—256K to 512K bytes—be available at once. Applications like word processing, data entry, and accounting may need only small amounts of information—perhaps 16K to 64K bytes—available at any given time because the micropro-

cessor can load additional information from mass storage as needed without significantly slowing the process.

The Sage II can be equipped with up to 512K bytes of RAM. While the IBM Personal Computer can be similarly equipped, 8-bit computers are generally limited to 64K or sometimes 128K bytes of RAM.

Sage II's 'RAM disk' allows file input/output to take place much faster than file I/O with an actual disk.

The Sage's extra memory space is valuable even if you don't run "memory hog" programs thanks to a feature that lets a block of RAM act like a disk drive. File input/output (I/O) using this "RAM disk" takes place thousands of times faster than file I/O with an actual disk. For programs that use disk files repeatedly, this can be a tremendous time-saver. The only qualification is that you must remember to copy data from that RAM disk to a real disk before you turn off the computer so the information won't be lost.

Mass storage capacity (floppy or hard disk) is the last key factor in computing power. It usually determines the maximum size of your data files because such files generally cannot be split between two disks. Mass storage capabilities also determine whether many sophisticated applications are practical or even possible.

The Sage II comes with one or two floppy-disk drives capable of storing up to 640K bytes on a single disk. (Compare the IBM Personal Computer's standard 160K-byte disks and the Texas Instruments Professional Computer's 320K-byte disks.) It takes about a second to load a 20K-byte program on the Sage II, about the same as on the IBM PC.

For those needing even more mass storage capacity, Sage recently introduced the Sage IV, a model that extends the power of the Sage II by replacing one of the floppy-disk drives with a 5- to 30-megabyte hard-disk unit. This adds multiuser capabilities (up to six users) and expands RAM capacity to 1 megabyte. The Sage II can be upgraded to a Sage IV.

In summary, on the basis of hardware alone the Sage II meets the criteria for a high-performance machine better than any other personal computer we've seen in this price range (under $4000). But that doesn't mean it's the ideal choice for everyone, as we'll see shortly.

Setting Up the Sage II

The Sage II is a single-board computer; it does not include plug-in slots for expansion boards in the style of an Apple II or IBM Personal Computer. Instead, it contains a number of standard interfaces with connectors on the back panel. Rather than using devices designed specifically for the Sage's system bus, you can connect a variety of off-the-shelf components.

The first thing you'll want to connect is a terminal, of course, so you can get information in and out of the machine. One of the Sage II's serial I/O ports is intended for this purpose, allowing communications at up to 19,200 bits per second (bps). This high communications rate is valuable because at lower rates (such as 9600 bps) you waste time waiting for the computer to update the terminal's screen.

Sage distributes the Televideo Model 925 terminal ($850) with its computer, and we found it to be a good match. However, just about any standard terminal can be used. Sage offers the Liberty Electronics Freedom 100 ($590) as an economical alternative.

The Televideo Model 925 contains its own parallel printer port for producing hard copy of everything that is displayed. It also provides a superb 101-key keyboard and a green-phosphor screen with nonglare surface. Screen characters are highly readable and can be displayed at normal or reduced intensity with blinking, underlined, and inverse characters as options.

Setting up the Sage and a terminal is simple. You connect them using a supplied cable, plug in the two power cords, and turn on the power. The process isn't quite so simple, however, if the terminal's configuration switches aren't set properly by the dealer or manufacturer. In that case, you'll have to do some digging in the terminal's reference manual to find out what communications parameters (rate, word length, parity, and similar details) it uses and how to select them. For this reason, we strongly recommend that you have your dealer set up and test the computer at the store.

The manuals supplied with the Sage II are comprehensive and well indexed. A 240-page manual describes the Sage II and how it implements the UCSD p-System. The p-System documentation itself fills more than 1200 pages. All documentation is reproduced from letter-quality printer output and bound in loose-leaf notebooks.

Though the manuals are informative, they are definitely not written for the beginner or the nonprogrammer. No demonstration programs or tutorials are included, so inexperienced users who are attracted to the Sage II because of its computing power should definitely arrange for the assistance of a dealer or a knowledgeable friend.

Software

The UCSD p-System is included in the purchase price of the Sage II. This powerful operating system from Softech Microsystems Inc. (16885 West Bernardo Dr., San Diego, CA 92127) has a market value of about $1400. It is an integrated package of program development tools and support utilities that allows you to write programs in Pascal, FORTRAN, or BASIC.

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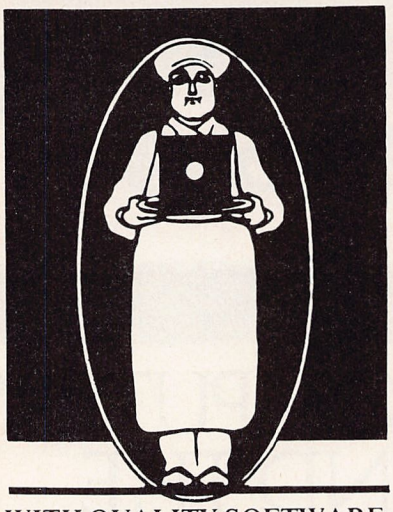

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You can even write a single program that uses all three. In addition, the p-System includes a screen-oriented text editor for use in creating source programs; it includes many features to speed the programming process. In short, the p-System gives the Sage II a powerful environment for program development.

The p-System has other features that benefit users as well as programmers. Software portability is one of the most obvious. Not only can a program be moved from one computer model to another, but even the disk containing the program can be moved (assuming both computers use the same drive mechanism, of course). For example, you can take a program disk developed on the IBM Personal Computer's p-System, plug it into the Sage II drive, and run it with no modifications whatsoever.

In this regard the p-System has a distinct advantage over CP/M, which is specific to one family of microprocessors. The same p-System program could run on computers equipped with 6502, Z80, 8088 or 68000 microprocessors. However, this degree of portability is realized only if programmers follow certain guidelines in designing software; not all p-System programs are transportable.

Performance often suffers when a program is transported to another microprocessor. For example, a program transported from an 8-bit to a 16-bit computer often must shackle the more powerful machine with the limitations of an 8-bit unit. The p-System shines here, too, because transported programs *are* able to take advantage of the specific characteristics of the host microprocessor. As evidence of this, we found that in our benchmark test the same program ran four times faster on the Sage than on the IBM PC.

Several p-System programs are available specifically for the Sage II. Software Products International (10343 Roselle St., San Diego, CA 92121) offers Logicalc, an electronic spreadsheet, and Logiquest, a database management program. The entire line of Flexware business software from Microfinancial Corporation (15404 East Valley Blvd., City of Industry, CA 91746) runs on the Sage II. PCD Systems (POB 143, Penn Yan, NY 14527) offers a variety of applications plus several technical tools for programmers. Many other general p-System programs are listed in the 53-page UCSD p-System applications catalog.

The Sage II is one of the first machines capable of running Digital Research's CP/M-68K, a version of CP/M for 68000-based computers. Many business-oriented users may prefer this new operating system; more than 2000 CP/M-80 programs are available, and many of these are bound to be translated into CP/M-68K.

A Sage Choice?

The Sage seems ideal as a scientific and engineering workstation. Both IBM and Hewlett-Packard have recently introduced similar products based on the Motorola 68000, but with its built-in IEEE-488 bus and FORTRAN language support, the Sage II seems an economical alternative to these machines in the technical market.

But the real market of the Sage is larger than that. Because a large body of p-System software for the Apple II and IBM PC will be available, the Sage II becomes an extremely powerful substitute for those machines. Furthermore, the availability of CP/M-68K will attract plenty of business applications.

We can't recommend the Sage II to the beginner or to users whose most demanding application is word processing. Sage assumes a fair degree of technical competence on the part of the user, and the computer is unnecessarily fast for use as a word processor. On the other hand, it is an excellent choice for an individual or business with computer expertise and the need for a real workhorse. □

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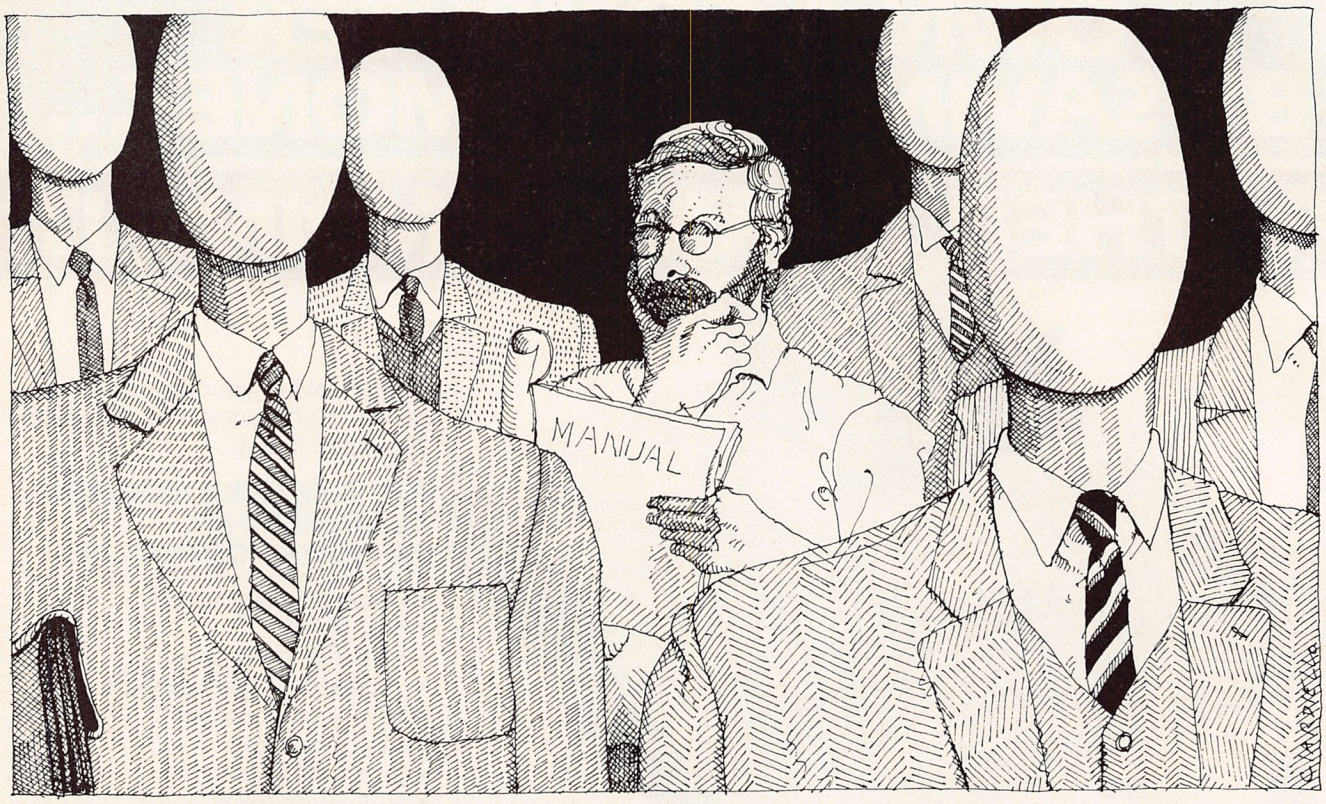

Demanding More of Manuals

Will they ever contain straight talk about system flaws?

by Michael Rossman

"Hey, is that a Dazzle?" asked the college kid standing beside me admiring the sleek contours of my very own Truly Portable Microcomputer as we waited for the light to change.

"It sure is," I said proudly, glad to have a chance to rest its weight on the curb while we discussed its other virtues. I suppose he took me for the fellow in the ad, the slick, $50,000-a-year account executive rushing to catch a jet and stow his Dazzle under his seat.

"I hear it comes with a really good user manual, too," he ventured.

"Aw, it's not too bad," I mumbled, reluctant to shatter his illusions. Then I confessed that it had been tough scraping up enough cash for the Dazzle, even at its breakthrough price (just under $2000). And because that purchase wiped out my nest egg, I explained, I have to trot the darned computer over to a friend's house when I need a letter-quality printout.

The kid's queries ceased once he understood why I was lugging my machine across the hot pavement. I

Illustration by Joseph Ciardiello

didn't have the heart to tell him that I was still searching for a helpful, no-hype user guide.

Hey, look—I'm not trying to pick on the Dazzle or even to single it out by name. Its support literature is more comprehensive and better organized than most other user manuals, but it's still a far cry from the guide I need. I'm just a typical "low-end" user, and they sure didn't write the manual for me. They wrote it for that fellow in the ad.

You know all about him, I'm sure. He's the Upscale Consumer—naive, romantic, and affluent. He bought his Dazzle to get instant, effortless access to the magical power of applications programs. He knows that the Dazzle and its software were flawlessly designed and that his system will run well for years, providing he doesn't spill too much Perrier on it.

The Upscale Consumer is mighty glad that American know-how has produced silicon gates and stepper motors, but he doesn't need or want to understand how these things work (or fail) and probably couldn't if he tried. He doesn't even want to be reminded that he's using a *machine*, much less to bother with the grubby business of maintaining it or modifying its software. Leave that to the hackers. The Upscale Consumer just wants the system to work like the full-color ad says it will.

As for me, I live in the real world of flawed machines and limited means, and I'd sure appreciate a user guide written for me instead of for some well-dressed mannequin traveling in the first-class section. I think that's true for a lot of us who aren't jet-setters or second-system purchasers—just modest, marginal professionals. We work alone or in businesses and organizations with little clout, and we buy computers like the Dazzle not so much because they're portable, but because they bring practical business tools within our grasp.

We "little guys" need just as much support as the owners of high-priced systems do, but we usually get less. In the first place, the dealer makes very little profit on the sale of a Dazzle. And because of all the free programs that come with the computer, the dealer probably reasons that it'll be a cold day in Hades before he sells Dazzle owners another piece of software. Besides, we're not the type who can afford to drop in every other week for an expensive peripheral. Why would any dealer bend over backward to give us speedy answers and prompt service?

That's why it's imperative that our support literature be more comprehensive than most user guides are designed to be. And we also need a different style of support—one that recognizes the fact that many of us want to be more than passive users of products others create, users totally dependent upon specialists when something needs fixing or changing.

You see, I don't want to relate passively to *any* tool, let alone one as powerful as the microcomputer. I didn't learn to tune up my own car and change its brake linings until I was 30, but I've had a different relationship with my car ever since, and I like the feeling. I refuse to be baffled by the black-box mystique of the computer. Revolutionary or not, it's just another machine, and I want to make it mine.

Believe me, I'm not the only computer owner who yearns for this type of active involvement with the machine. There are hundreds of user groups, of course, and their newsletters are generally much more honest and informative than vendor-supplied manuals. But these newsletters can get a bit parochial simply because they represent only a small fraction of the computing community. So if you exclude supercilious product literature and insular newsletters, the Dazzle owner's principal resource is scuttlebutt—yes, the gossip you hear if you're lucky enough to know someone with the same problem.

They call us 'the knowledge workers' then deny us the knowledge of what went wrong on the assembly line and what corrective measures they took.

My Dream Manual

Let me tell you about a beautiful dream I had the other night. In my slumber, I was flipping through the pages of a user manual—the most honest and illuminating one I'd ever seen. Here are some excerpts:

"Like any new product, this computer has some minor flaws you should be aware of, although we're trying to eliminate them. In the first 20,000 units we shipped, the covering on the keyboard cable tends to fray. If it does on yours, remove the two screws securing the keyboard to its case in order to expose the fraying end fully, then tape it securely. Filament tape works best.

"To cut costs and keep production moving smoothly we used a variety of inexpensive disk drives from several suppliers. Because of this the drives tend to whine and rattle. Don't worry about this unless trouble shows up on the screen or the noise grows significantly worse. And don't worry if your Dazzle's drives sound different from your friends' or even different from each other; they're probably of different makes."

With this honest tome tucked under my arm, I rush to tell all my friends, dancing joyously from house to house like Gene Kelly on the M-G-M back lot. We finally have our tell-it-like-it-is user guide! They've finally paid attention to the little guys!

But that's where the dream abruptly ends. We're never going to have forthright manuals that allude to system flaws, not as long as vendors keep worrying

Michael Rossman is a freelance writer based in Berkeley, California.

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about "maintaining a positive image." Their ad execs are still hung up on macho copy—words like "potency," "power," and "reliability." The vendors are apparently convinced that news leaks about hardware problems would send buyers shrieking out of the stores and company stocks plunging to Jacques Cousteau depths.

But no amount of PR or advertising can hide the fact that the computer industry is feeling its way from month to month. The power and potency of Next Month's Model isn't going to help the person who's limping along with a computer bought in '81 or '82—a product that might have been rushed out the door with minor, but wholly fixable, problems. All that a manufacturer's silence on this score can accomplish is to anger and alienate the buyer when those problems hit home.

Despite what many of the marketing directors say, I'll wager that candor would be good for sales. As I see it, the first vendor that has the guts to back up a good product with unblushingly honest user guides and updates will immediately be crowned the customer-loyalty champ.

The user guide I envision would include a tutorial appendix with sections such as "How to Solder" and "How to Use a Volt-Ohmmeter." Most computer owners don't realize—and have never been told, naturally—that a new computer cable costs more than the soldering iron and volt-ohmmeter needed to make (and test) your own. And you can use those tools for other wiring jobs around the house too.

Ah, but how can a computer manufacturer offer such helpful advice when it chooses to deny that a hardware problem exists or threatens to void your warranty if you do your own soldering? No matter that the warranty expires a mere three months after purchase; some companies would rather hustle you into a service contract than teach you some basic repair skills that could keep the computer out of the shop and double its life.

It's ironic that so many computer vendors pay homage to "the knowledge worker" while denying us the knowledge of what went wrong on the assembly line last fall and what corrective measures have been taken. And the entire industry is jealously guarding the knowledge that many computer products aren't really breakthroughs at all—they're just much-needed improvements of previous releases.

The average consumer is beginning to clamor for this kind of knowledge, but the Upscale Consumer couldn't care less—and *that's* the person the industry is pursuing. So the next time you take an airline seat next to a well-dressed mannequin with a Dazzle stowed below, take a closer look. That's no mannequin, my friend. That's a real dummy! □

[Editor's Note: *It's obvious that the "Dazzle" brand portable computer exists only in Rossman's imaginative cerebrum—but we're hoping his Dream Manual becomes a reality!* . . . **L.M.]**

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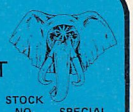

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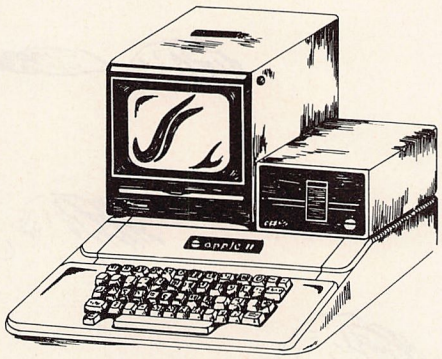

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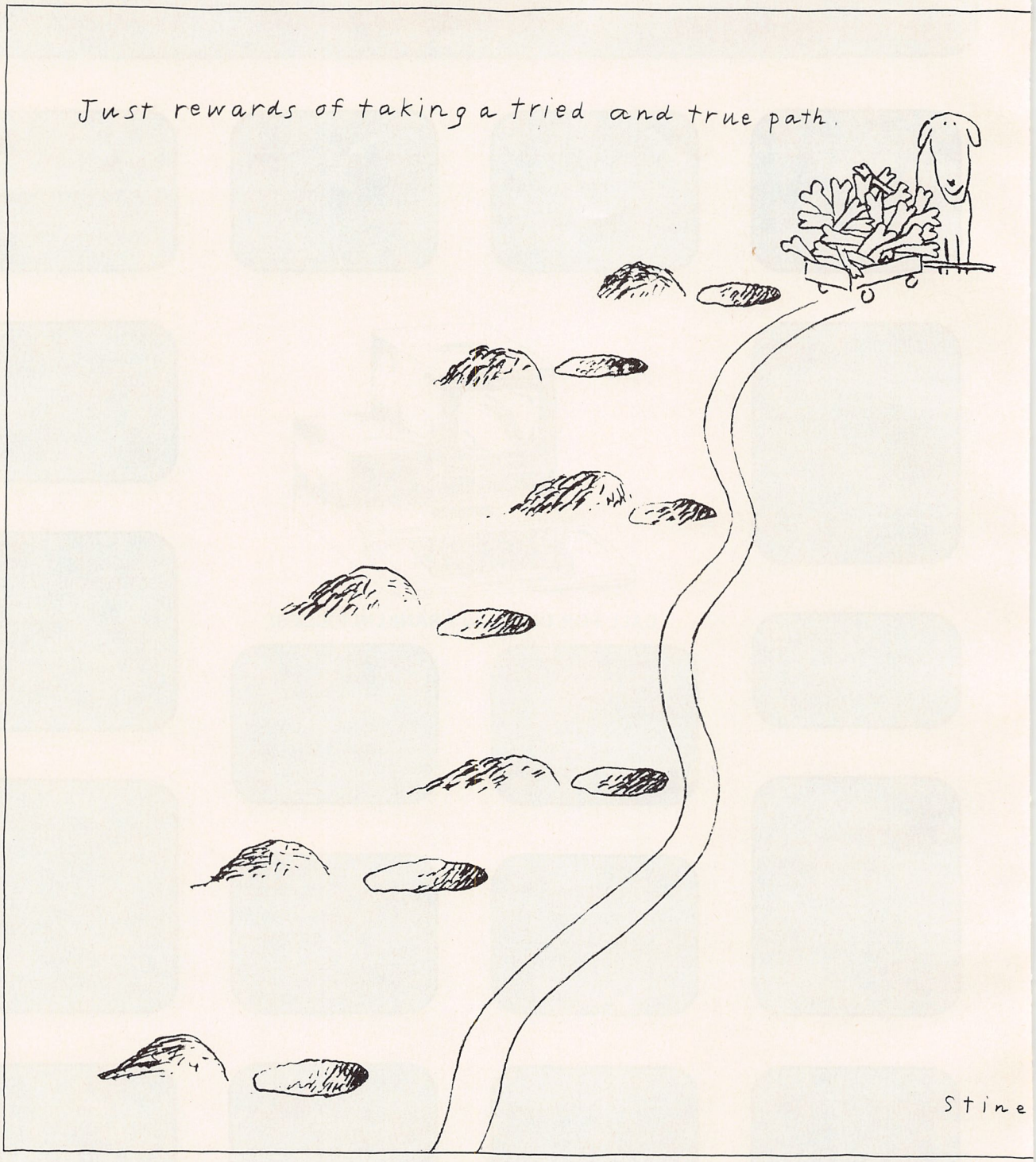

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Part 1 One

CONTINUED FROM PAGE 95

Cupertino, California, said that the trick is to be "smart enough to tell the kids when you don't know something." She added that in most cases when her students have a problem, "they don't ask me; they'll ask the other kids."

Some critics have expressed fears that because computers demand such attention from students, they will have the effect of undermining a school's social life. In practice, though, educators are finding that just the opposite occurs. There are still plenty of "computer nerds" who seem to spend all their time glued to their microcomputers, but then the same has always been true of some individuals in just about every human activity. The experience of most schools has been that the presence of computers actually enhances social contact, mainly because students become interested in what others are doing. They roam around computer rooms peering over others' shoulders, work together to debug programs, and develop elaborate networks for sharing programs.

Finally, some educators predict that computers will eventually alter the way students think and learn. Kristen Eastman, a teacher and administrator in Provincetown, said that computers force students "to be very specific and develop sequential thinking." For a child to make a square, for example, she noted that "he or she must figure out that eight steps are involved." Central to this process, she added, is the child's relationship to the machine. She recalled one child who remarked, as many do, that the computer was stupid and couldn't do anything by itself. "He had to realize that to get anything out, you first have to put something in," she observed. "The computer brings out more curiosity in a child. It's an active involvement."

Ellen Richman of Chagrin Falls agreed. "We are practically forcing students to think logically," she said. "We traditionally have said to students, 'You did not follow directions.' Now we tell them, 'You write the program—you start it, you plan and design it.' "

Altered Objectives

Computers could also alter many of the objectives of education, including the amount of material that students are expected to carry around in their heads. Herbert Simon, the psychologist who won the 1978 Nobel Prize in economics, has suggested that new information systems have changed the meaning of the verb "to know" from "having information stored in one's memory" to "the process of having access to information."

Others say that the major impact of computers on higher education lies in their capacity to force new kinds of thinking. Allen Newell, one of the pioneers in the field of artificial intelligence, suggested a parallel with the invention of calculus. Just as calculus permitted people to think in a new way about certain kinds of physical change, he argued, so computers offer the chance to work with an infinite number of variables in a way that could never be done before. "Both advances made it possible to see the world differently," he said. George A. Miller, a psychologist at Princeton University, made a similar point. "Schools are being asked to enable people to live symbolically," he said. "More and more people will become useless if they cannot live at this symbolic level."

One continuing problem is the generally poor quality of software, which for the most part remains locked in the "electronic flash card" stage of evolution. "Despite all of the catalogs, options, and offerings, there is precious little good software," said Provincetown's Tocci. The real need, he said, is for much more software such as Logo, which places the learner in charge of the machine. "Logo demands interactive programs," he said. "With Logo the operator has to do it all."

However, Dennis Dempsey, principal of the Wood River Junior

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High School in Hailey, Indiana, told *Electronic Learning Magazine* that the situation is improving. "When I first started out, it was easier to write your own than it was to buy the stuff," he declared. "Now it's really improved, and I feel a lot more confident. But there is such a large amount coming out that a single teacher or a single school district can't evaluate it all. You've got to set up some form of computer group or central library so you can find out who is using what program and whether it's any good."

Community Support

Educators experienced in the use of computers say that the success of computer literacy programs often depends on how much support they develop among parents. "We live in a pretty conservative rural community," commented Raymond Yeagley, superintendent of Alexander Local Schools, a small district in Ohio. "The feedback we got was to stick with basics, indicating that taxpayers would regard computers as just another frill." So Yeagley and his colleagues set out to bring parents into the school. "Once the parents see what their children are faced with, they have become more helpful," he reported. Moreover, he added that the program "provides lifelong learning for parents. It's a form of job retraining for many of them."

Yeagley said that the net result of his public relations was a greater sense of community in several ways. "Teachers were thought to have all the answers," he said, "but this new technology is unfamiliar to them. Parents and youngsters now see teachers as more human. It brings everyone closer together. The computer is nonthreatening. It does not pit one group against another. Everybody is trying to figure out how the thing works."

Houston has gone a step further in instituting a loan program that enables parents to borrow computers to help tutor their children. Last September, for example, Eliseo Almaguer, a 32-year-old maintenance worker, and his 6-year-old daughter Evonne and 12-year-old son Eliseo Jr. signed out a Texas Instruments microcomputer with voice synthesizer and hooked it up in their modest two-bedroom home where the only other sign of modern technology was an old TV set. "We sometimes went the whole evening with it," he said. "It was a lot of fun."

Social Issues

The rapid proliferation of computers in schools across the country also raises some potentially complex social and ethical issues. Princeton's George Miller put his finger on the most obvious one when he observed that "the critical question is whether computers are going to be available to everyone."

Much of the urgency of this issue lies in the growing relevancy of computer literacy to employment. Social scientists write frequently about the emerging "knowledge society" in which access to information is critical to power and success. IBM has predicted that in the not too distant future 75 percent of the work force will need some computer skills to perform their jobs. The relevance of these trends for schools in disadvantaged areas is obvious. "Unless all children are taught to use this new technology," said Peggy Charren, president of Action for Children's Television, "we are in danger of creating a whole new disadvantaged class of people."

Public schools are the ideal vehicle for assuring broad access to the new technology. But the differences in the resources of rich and poor school districts are already considerable, largely because we finance schools through local property taxes. It is a very serious question whether poor districts will be able to make the needed investments in computer hardware and training for their teachers.

The problem is compounded by the fact that a growing number of

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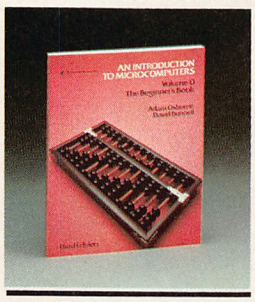

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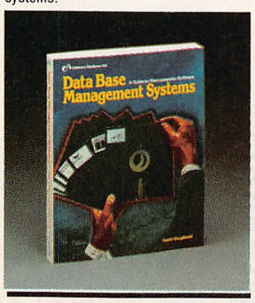

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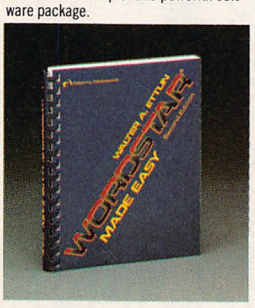

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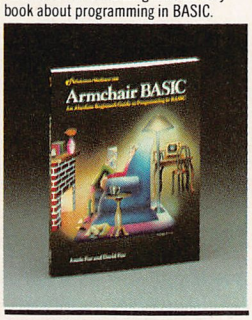

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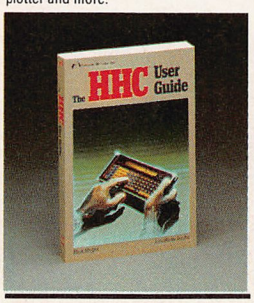

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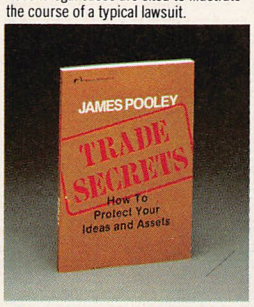

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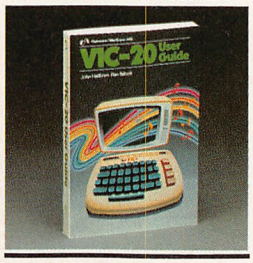

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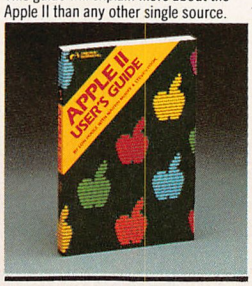

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middle-income families now have computers in their homes. "With inner-city kids, their only contact with high technology is through video games," said Richard Colvario, a computer instructor at the Hubert Humphrey Occupational Resources Center, a mammoth, ultramodern vocational high school in Roxbury, Massachusetts. "Suburban kids might have computers at home or parents working in the industry."

William Zachmeier, acting superintendent of the Cupertino schools, has one goal that would solve at least the latter problem. "By the end of this decade," he said, "I hope that this district will give computers to each child when he or she begins school—one for home and one for school."

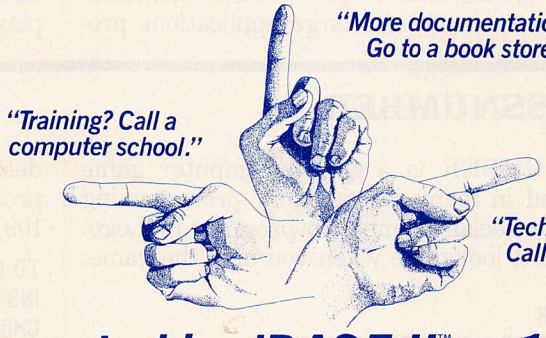
Another social issue is the computer's potential for changing the apparent differences in the ways that girls and boys perceive work in math, science, and technology. For the last decade, studies have been reporting girls' fear of math and hard science—"math anxiety" is the usual term—and their tendency to avoid advanced study in mathematics and sciences, such as physics, that require math. Although high school computer clubs remain a male preserve, some think the overall effect is positive. "Women find themselves able to do math on the computer," said Adeline Naiman, managing director of Technical Education Research Centers in Cambridge, Massachusetts. "It doesn't carry the stigma. The computer is approachable and very commonsensical."

Changing Jobs

In the long run this feature of computers—user-friendliness, if you will—may be the most important factor in its acceptance in American schools. Students, parents, teachers, administrators, and others are concluding not only that computers are going to be an integral part of the future of today's schoolchildren but also that they are steadily becoming something to be learned, not feared.

This change, of course, will not happen overnight. Most pundits feel that we won't see a truly user-friendly computer for at least 10 years. Still, teachers should be aware that their new mechanical aides are drastically changing their jobs. At a recent school science fair, 16-year-old Victor Wong, a tenth-grader, was demonstrating a new program that he had designed on his Atari home computer to help him drill in five different subjects. Wong's program was aptly named Replacement of Teacher by Computer.

"What can a teacher do that a computer can't do and do much faster?" he asked as the blue-and-white monitor on his computer displayed questions. "It thinks faster than a human being. It doesn't make mistakes. It can teach more than one subject. And, most important, it doesn't get mad." □



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CONTINUED FROM PAGE 112

It's impossible to talk about list processing without mentioning *recursion*, the process by which a procedure calls another version of itself as a subprocedure. Procedures that process lists of data use recursion to work through them step by step. An example of the use of recursion in list processing is given in "The Magic of Recursion" on page 156.

The Limits of Logo

Despite its powers, Logo has some disadvantages as a programming language. First of all, Logo is an extremely complex system that fills a large part of your computer's memory. Most of the 64K bytes of random-access memory (RAM) available on an Apple II with a 16K-byte RAM card is filled up when you load Logo itself, leaving precious little space for your own procedures. This means that Logo on 8-bit microcomputers is not very useful for large applications programs or for programs that have to process a lot of data. Because Logo is also relatively slow compared to languages that have less elaborate internal structures, you would not want to use Logo for an application in which rapid processing was critical.

Some of these limitations may disappear when Logo moves to 16-bit microcomputers. DR Logo from Digital Research, when implemented on the IBM Personal Computer, should be able to access up to 1 million bytes of RAM—about seventy times as much as on an Apple. If this new system can also process data much faster than an Apple, complex applications programs written in Logo may become feasible very soon.

Other limitations stem from the graphics capabilities of different computers rather than from Logo itself. On some computers the lack of screen resolution diminishes the effectiveness of turtle graphics by displaying thick, jagged lines where you'd prefer to see

6 GUESSNUMBER

GUESSNUMBER is a simple computer game that is found in many introductory programming books. It's especially simple to program in Logo. Here's what it looks like when you play the game:

```
GUESSNUMBER
I AM THINKING OF A NUMBER BETWEEN
0 and 100. SEE IF YOU CAN GUESS IT.
>50
TOO LOW
>75
TOO LOW
>85
TOO HIGH
>80
TOO LOW
>82
TOO HIGH
>81
GOT IT!
```

GUESSNUMBER has three main subprocedures: INSTRUCTIONS, CHOOSENUMBER, and GETGUESS. GETGUESS calls the subprocedure READNUMBER to read the number typed by the player, and then it calls CHECKGUESS. If the answer is correct, the game stops, but if it is too high or too low, CHECKGUESS prints an appropriate message and calls another GETGUESS procedure. From then on, GETGUESS and CHECKGUESS keep calling each other until the correct number is guessed. Even though CHECKGUESS is a little more complicated—it contains three conditional statements—the structure of the program is almost as simple as the design of PERSON, the turtle procedure in "Subprocedures and Structured Programming" on page 109. GUESSNUMBER looks like this:

```
TO GUESSNUMBER
INSTRUCTIONS
CHOOSENUMBER
GETGUESS
END

TO INSTRUCTIONS
CLEARTEXT
PRINT [I AM THINKING OF A NUMBER BETWEEN]
PRINT [0 and 100. SEE IF YOU CAN GUESS IT.]
END

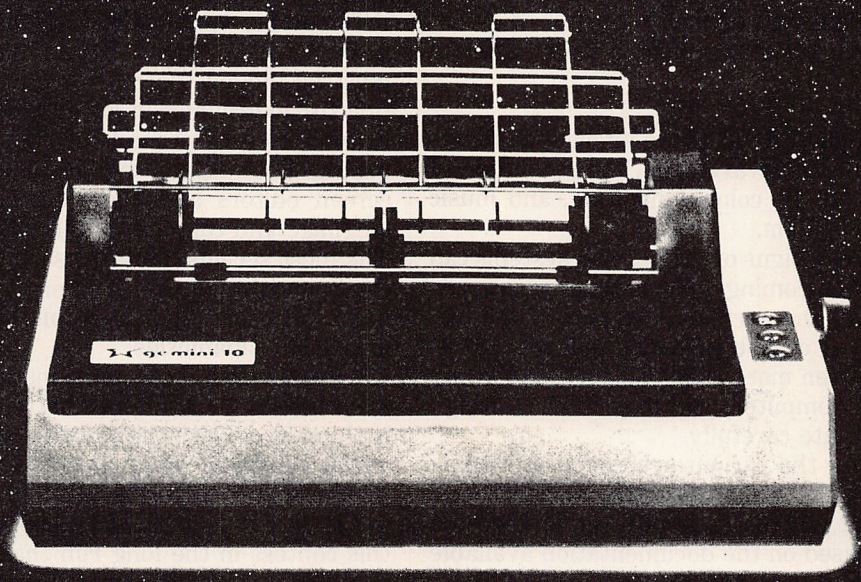
TO CHOOSENUMBER
MAKE "NUMBER 1 + RANDOM 99
END

TO GETGUESS
PRINT1 ">
MAKE "GUESS READNUMBER
CHECKGUESS :GUESS :NUMBER
END

TO CHECKGUESS :GUESS :NUMBER
IF :GUESS = :NUMBER PRINT [GOT IT!] STOP
IF :GUESS > :NUMBER PRINT [TOO HIGH] GETGUESS STOP
IF :GUESS < :NUMBER PRINT [TOO LOW] GETGUESS STOP
END
```

One important command introduced here is MAKE, which is used in CHOOSENUMBER to create (make) a variable called "NUMBER and assign it a random value from 1 to 99. MAKE is also used in GETGUESS to give the name "GUESS to the number typed by the user.

star war



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thin, straight ones. It can also be difficult to tell exactly where the turtle is pointing—another problem caused by limited resolution. As with speed and memory, graphics limitations should become less significant as microcomputers become more sophisticated.

Comparing Versions of Logo

The various Logo systems available today differ in four ways:

- Differences in computer hardware affect such things as the amount of memory available, the resolution of turtle graphics, and the color, animation, and music capabilities of the system.
- Differences in the designs of the various systems can be quite subtle, often coming down to whether a given feature is built into the particular version of the language or whether it can be implemented as a procedure if it is not. When more than one version is available for the same computer, you may want to weigh such distinctions quite carefully.
- Documentation for the various systems is still being polished, and because most Logo books and teachers' guides are not yet written, it is difficult to choose a version of Logo based on the documentation available today. One fairly safe prediction is that the more popular a particular version of Logo becomes, the more books and other materials will become available for it, and vice versa.
- Differences in the features included in given systems can be quite significant. Full versions of Logo that include list-processing capabilities are far more useful than products with "Logo" in their names that are limited primarily to turtle graphics. If you plan to purchase a computer system with Logo capability, make sure that it permits list processing. This is especially important for a school system to keep in mind when writing bid specifications. If list processing is not specifically mentioned, the contract may go to a low bidder who is offering an incomplete version of Logo.

If you are considering the purchase of an entire Logo system (hardware and software), the bottom line involves more than which version of Logo is the best or even which is the least expensive. Because you are likely to want to use your computer for other applications as well as Logo, you need to take several other factors into account. In addition to the following reviews of currently available and upcoming versions of Logo, those considering major purchases should see "Which Computer Should a School Buy" (*Popular Computing*, December 1982, page 140) and "Selling Micros to Schools" (*Popular Computing*, February 1983, page 48) for more information about buying an educational computer system.

Logo for the Apple

Apple owners have an embarrassment of riches when it comes to Logo. Two full versions of Logo are currently available for the Apple II. Terrapin Inc. and Krell Software Inc. distribute the version originally developed at MIT, which is now often called Terrapin/Krell Logo. Apple Computer Inc. distributes Apple Logo, its own version developed by Logo Computer Systems Inc. (LCSI) of Montreal.

The Apple versions of Logo have set the standard against which other microcomputer implementations must be judged. Both feature attractive, high-resolution turtle graphics in either black and white or color as well as a full complement of list-processing commands. Both Apple versions also contain easy-to-use screen editors and allow access to Apple machine language and communication with Apple peripherals. The most serious limitations of either version are the small amounts of user memory available (Apple Logo has a bit more than Terrapin/Krell) and the lack of animation capabilities.

I believe that both versions are outstanding. The most important difference between the two may have nothing to do with the software itself; it boils down to which version is most readily available in your area, which has the largest number of local users, or which one is used in your child's school. Apple Logo may win this contest in the long run thanks to the company's superior marketing power. Keep this in mind as you ponder the subtleties of the different versions.

For the beginner, Apple Logo is slightly harder to use. The syntax is just a little more complex and awkward. Commonly used Apple Logo commands such as EDIT, PO (print out), and ERASE require the use of quotes before the procedure name, as in EDIT "SQUARE. Apple Logo also has a separate procedure-definition mode that you enter by typing TO followed by a procedure name *without* quotes, as in TO SQUARE. If you want to change a procedure while you're defining it, you must type END to leave the procedure-definition mode and then type EDIT "SQUARE to enter edit mode. You must switch modes again to finish defining the procedure.

In Terrapin/Krell Logo, on the other hand, TO and EDIT do exactly the same thing, and no quotes are required. When you type either TO SQUARE or EDIT SQUARE, the screen is cleared and the computer switches to edit mode with TO SQUARE displayed at the top of the screen. You then type in a series of any commands (followed by END) and leave the editor by typing CTRL-C. While in edit mode, you can use a number of editing features to modify the text of the procedure quite easily. You can return to edit mode at any time by typing either TO SQUARE or EDIT SQUARE.

An advocate of Apple Logo's syntax might say that it forces a user to make a distinction between the *name* of a procedure ("SQUARE) and the command itself (SQUARE). It's true that once you get used to the Apple Logo system, typing quotes before procedure names will become automatic. For a beginner, however, it's one more irrelevant detail to remember

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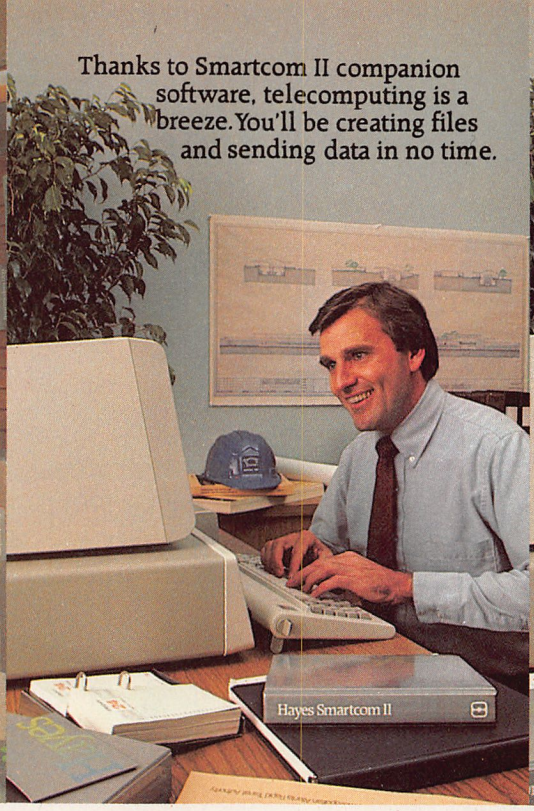

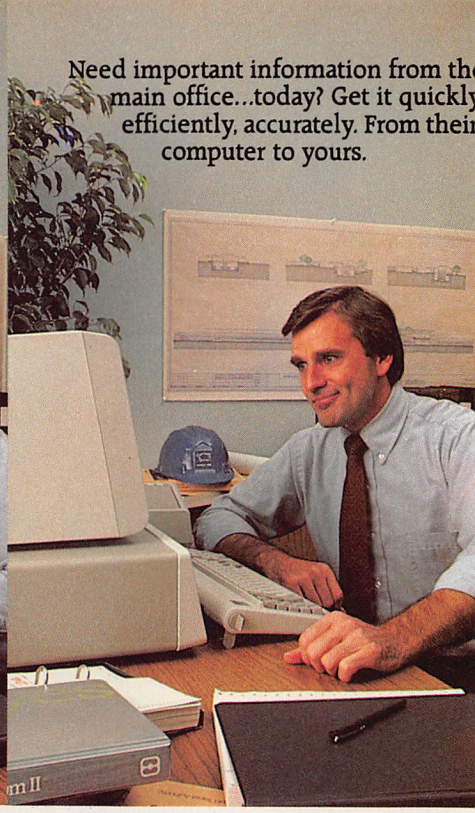

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while trying to master many more important concepts.

A small difference that could be important for beginners is that Terrapin/Krell Logo allows you to save turtle graphics directly on a disk. This is useful if you want to save a design without writing procedures for it or if you want to load a design quickly without waiting for the turtle to redraw it. Apple Logo does not offer this capability, but both versions allow you to print a copy of the screen (provided you have a printer with graphics capability).

Advanced Features

Both Terrapin/Krell and Apple Logo have advanced features that beginners may never use, but they could make a difference as you become more knowledgeable. I like both sets of features and wish they could be combined in one version. Your preference will depend on the Logo applications that are most important to you.

Apple Logo allows you to divide a complex collection of procedures into "packages" that can be saved or loaded as units. It also gives you the ability (borrowed from LISP) to create property lists that associate objects with their attributes. This makes it easier to create data-management systems, adventure games, and the like. While these property-list commands can be written as procedures in Terrapin/Krell Logo, having them built into the language makes them work much more quickly.

Another advanced feature of Apple Logo actually makes it easier for beginners to learn. Any version of Logo allows a teacher to create procedures for students to use as though they were Logo commands, but Apple Logo allows these procedures to be "buried" so that a student is unaware of them at first. If they are placed in a start-up file, they will be loaded into the computer automatically when the student inserts his or her file disk.

Advanced features of Terrapin/Krell Logo include the ability to create new Logo commands using assembly-language subroutines. For example, the utilities disk that comes with Terrapin/Krell Logo contains routines that generate a rudimentary sort of music using the built-in Apple speaker. Another set of routines lets you define new shapes for the turtle and stamp them in different places on the screen. The same capabilities allow an assembly-language programmer to create subroutines for peripheral devices such as the robot turtle manufactured by Terrapin.

Documentation and Supporting Materials

Documentation options provide a clear distinction among the distributors of Apple versions of Logo. There are really three choices here; Terrapin and Krell, while distributing the same version of Logo, offer different supporting packages.

Terrapin's well-written introductory tutorial covers

7 Building Sentences with Lists

List commands in Logo can be used to play with language in a way that's almost as easy as playing with the turtle. Consider this procedure called SILLY.

```
SILLY
BASEBALLS FLUTTER
COWS FLY
HATS CHATTER
DOGS TALK
```

SILLY prints an unending set of random sentences.

```
TO SILLY
PRINT SENTENCE NOUN VERB
SILLY
END
```

NOUN and VERB are Logo procedures that generate outputs; that is, they send messages back to the procedure or command that called them. In this case they are called by SENTENCE, a Logo command that combines words into a list. NOUN and VERB are very similar.

```
TO NOUN
OUTPUT PICKRANDOM :NOUNLIST
END

TO VERB
OUTPUT PICKRANDOM :VERBLIST
END
```

PICKRANDOM is a procedure that randomly chooses an element from a list. Before you can use NOUN and VERB, you have to create two lists using the command MAKE. For example:

```
MAKE "NOUNLIST [BOYS DOGS HILLS CATS COWS HATS...]
MAKE "VERBLIST [JUMP EAT FLY SWIM FLUTTER CHATTER...]
```

SILLY can be extended to make longer and more interesting sentences. You can use them to explore language patterns just as the turtle is used to explore geometric patterns.

The Logo Poet

Of course it's rather ridiculous to make the computer print silly sentences. Instead, let's make it create "poetry." Here are two examples:

Logo's turtle graphics quite thoroughly, but it does not describe list processing at all. Along with Terrapin's tutorial comes a terse technical manual from MIT with a full Logo glossary, information for assembly-language programmers, and instructions for using the utilities disk that comes with the package. The utilities disk contains subroutines for music and for changing the turtle's shape as well as some sample Logo programs.

Krell offers a less expensive Logo package that includes a back-up copy of Logo, the MIT technical manual and utilities disk, a rather ineffective tutorial disk called Alice in Logoland, a nice wall chart of Logo commands and sample procedures, and a sample copy of Krell's *Logo and Educational Computing Journal*. It's my feeling that Krell's package does not really provide enough information to get someone started with Logo; you'll need at least one other Logo tutorial book to round out its documentation.

Apple Logo comes with two manuals. *Introduction to Logo Programming through Turtle Graphics*, by Cynthia Solomon, one of Logo's original developers, provides a clear, straightforward introduction to Logo. The second book, *Apple Logo Reference Manual*, gives background information on how Logo works and stresses the list-processing aspects. Readers who are not experienced Logo programmers may find some of this manual tough going, but it's packed with interesting and useful information about the language.

If you want to understand more about Logo than introductory turtle graphics, you'll soon need to supplement any of these packages with other books or materials. See "A Quick Logo Reference Guide" on page 162 for further information.

TI Logo

TI Logo, developed jointly by the MIT Logo Group and Texas Instruments Inc., was the first microcomputer implementation of Logo as well as the first version to feature sprites. TI Logo also offers capabilities for list processing, a full-screen editor, and both turtle and character graphics. The updated version of the system (TI Logo II) includes a three-voice music synthesizer and expanded user memory, and also corrects some annoying minor bugs that plagued the original version.

With its improved features, TI Logo II is an exciting product. Although it still has limitations that make it less suitable for students of high school age and older, I would strongly recommend that current TI Logo users purchase the upgraded version.

Special Features

The most outstanding feature of TI Logo is its ability to create complex animations using as many as 32

```
THE EMPTY RIVER
A SUNSET FLOATS NEAR EACH DARK RAIN
DELICATE STILL BUTTERFLY

EVERY SWIRLING FOREST
A FIREFLY MURMURS OVER THE WILD BROOK
MISTY FROSTY NIGHT
```

Can you guess what procedure would be needed to create these? It's rather simple:

```
TO POET
PRINT LINE1
PRINT LINE2
PRINT LINE3
END

TO LINE1
OUTPUT (SENTENCE ARTICLE ADJECTIVE NOUN)
END

TO LINE2
OUTPUT (SENTENCE ARTICLE NOUN VERB PREPOSITION
ARTICLE ADJECTIVE NOUN)
END

TO LINE3
OUTPUT (SENTENCE ADJECTIVE ADJECTIVE NOUN)
END
```

This time we need five different word procedures (one for each part of speech used in the poem), but each one is similar to the NOUN and VERB procedures given earlier. The chosen sentence patterns and the particular lists of words used make this sound like poetry. In this case the sentence patterns imitate a haiku-like poem and the words all pertain to nature.

```
MAKE "NOUNLIST [BREEZE WATERFALL RIVER FIREFLY
RAIN ...]

MAKE "VERBLIST [SHAKES DRIFTS FLUTTERS FLOATS
MURMURS ...]

MAKE "ADJECTIVELIST [AUTUMN HIDDEN BUBBLING GREEN
BITTER DARK ...]

MAKE "ARTICLELIST [A ONE THE EACH EVERY ...]

MAKE "PREPOSITIONLIST [UNDER OVER NEAR BEFORE ON
ABOVE ...]
```

8 The Magic of Recursion

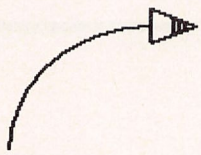
Recursion is an aspect of Logo that is often talked about but not very well understood. You can think of it as a programming technique, as a way of thinking about problem solving, or, more philosophically, as an organizing principle for all living systems. Douglas Hofstadter develops the philosophical aspect of recursion beautifully in his Pulitzer-Prize-winning *Gödel, Escher, Bach: An Eternal Golden Braid* (Basic Books, 1979) and in his monthly "Metamagical Themas" in *Scientific American*.

Recursion is a process in which a procedure calls a version of itself as a subprocedure. At first the idea seems quite mysterious. How can you teach a computer to do something when one of the things you tell it to do is the very thing you are now teaching it?

As with other aspects of Logo, rank beginners can easily use recursion to accomplish simple tasks like drawing circles, but it is also central to extremely complex projects that stretch the mental powers of the most experienced programmers. It is most powerful when its use helps make a concept very clear or a complex process extremely simple to describe.

A common example involves teaching the turtle to draw a circle. The figure shows the turtle in the recursive process of drawing a circle.

```
TO CIRCLE
FORWARD 1
RIGHT 1
CIRCLE
END
```



When you give the command CIRCLE, the CIRCLE procedure moves the turtle forward one step, turns it right one degree, and calls on a *second* CIRCLE procedure. This new procedure moves the turtle forward, turns it, and calls on a *third* CIRCLE procedure, and so on. The important thing to understand is that a *new* procedure is called each time.

To visualize the recursive process, think of each procedure as a worker carrying out a specified task. Each newly called CIRCLE procedure is another worker helping the worker that called it. Eventually you'll have a long chain of CIRCLE workers each helping out the one before. Recursion is not at all the same as a single procedure that carries out the same set of commands over and over again in an infinite loop.

Reversing a List

This example shows how recursion is used to process lists of information. Suppose you want to put a long list of words or numbers in reverse order. If you had a helper who could reverse everything but the first item on your list, the rest of the problem would be trivial. Just add the first item of your original list to the end of the new list your helper gives you and voilà—the problem is solved! If you had such a magical helper you could just about go home, and if your helper had a helper who knew how to reverse a still shorter list, he'd be all set. Here's a Logo procedure that follows this plan:

```
TO REVERSE :LIST
IF :LIST = [ ] OUTPUT [ ]
OUTPUT SENTENCE (REVERSE BUTFIRST :LIST) (FIRST :LIST)
END
```

The first line after the title line tells a worker what to do if the list is empty: send back (OUTPUT) an empty list ([ ]). (If you reverse an empty list you'll still have an empty list, right?) The next line is the key to the process; it sends back a new list (OUTPUT SENTENCE) made by reversing everything but the first thing on the original list (REVERSE BUTFIRST :LIST) and then adding the first item of the original list (FIRST :LIST) to the end of the new list. To do this, REVERSE calls on another REVERSE procedure as a helper, with a shorter list as its input, and this new procedure calls on another procedure with a still shorter list as its input, and so on. (For a more detailed description of this process, read one of Harold Abelson's books listed in "A Quick Logo Reference Guide," page 162.)

The Tower of Hanoi

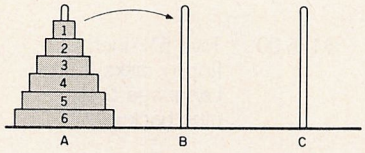
Here's an example that shows the power of recursion to make a really complex problem almost ridiculously easy. You may be familiar with the puzzle called the "Tower of Hanoi" (it goes by many other names as well) in which you're given a

sprites. Sprite shapes are formed by specifying dots in a 16 by 16 grid, and a built-in shape editor lets you easily construct shapes using the four arrow keys and the FCTN key. Children using TI Logo tend to get hooked more easily on sprites than on the turtle. Having all of those objects on the screen at once and being able to create animated fantasy worlds can be quite a heady introduction to computer programming.

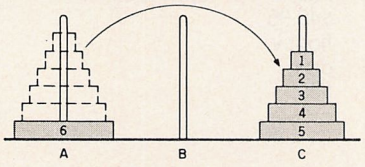
Unfortunately, TI Logo's sprites do not lend themselves readily to the creation of video games. The problem is the slowness with which the system processes information about the positions of different sprites. What's needed is a built-in command to detect collisions between sprites. Such a feature would make video games easier to write and create a more powerful programming environment for children.

TI Logo also features 256 user-definable 8- by 8-dot characters or *tiles*, including 64 predefined alphanu-

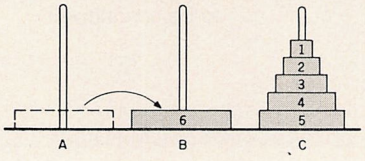
pyramid of concentric disks stacked on a pole and you have to move them all to another pole.



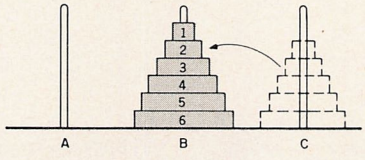
The catch is that you must move the disks one at a time and you can never have a larger disk resting on a smaller one. You can use the third pole as a temporary resting place for some of the disks while you move them. The recursive solution to this problem is so simple it seems like cheating. To move all the disks from pole A to pole B, first move all but the bottom disk to pole C temporarily.



Then move the bottom ring from pole A to pole B.



Then move the all the disks that were temporarily moved to pole C to pole B.



If you physically picked up all the disks and did this, you'd be breaking the rule that says the disks can be moved only one at a time. But if you had a helper who knew how to move the shorter pile of disks legally, you'd have it made. Here's a Logo procedure that does this:

```
TO MOVESTACK :N :START :FINISH :TEMPORARY
IF :N = 1 (MOVEONE :START :FINISH) STOP
MOVESTACK :N-1 :START :TEMPORARY :FINISH
MOVEONE :START :FINISH
MOVESTACK :N-1 :TEMPORARY :FINISH :START
END
```

MOVESTACK uses four input variables. :N is the number of disks to be moved, and :START, :FINISH, and :TEMPORARY stand for the names of the three poles. MOVESTACK needs a helper (MOVEONE) that knows how to move one disk from one pile to another.

```
TO MOVEONE :START :FINISH
PRINT (SENTENCE [MOVE THE TOP DISK FROM POLE] :START
  [TO POLE] :FINISH)
END
```

In this simple version, MOVEONE just prints a message telling which disk to move and where to move it. A more complicated version could draw a disk on a screen and visually move it, of course, but that, as they say in textbooks, is left as an exercise for the reader.

To tell the computer to move a three-disk stack from pole A to pole B using pole C, you would type the command MOVESTACK 3 "A "B "C. When MOVESTACK and its helpers go to work, you'll see these instructions printed out:

```
MOVE THE TOP DISK ON POLE A TO POLE B
MOVE THE TOP DISK ON POLE A TO POLE C
MOVE THE TOP DISK ON POLE B TO POLE C
MOVE THE TOP DISK ON POLE A TO POLE B
MOVE THE TOP DISK ON POLE C TO POLE A
MOVE THE TOP DISK ON POLE C TO POLE B
MOVE THE TOP DISK ON POLE A TO POLE B
```

If you actually follow these instructions you will see that it is a perfectly legal and accurate solution to the Tower of Hanoi problem with three disks, and moreover, it's the shortest legal solution to the problem. If you test the program for a greater number of disks, you will always find the best legal solution for that number of disks, but it may take a lot of room to print the directions because the number of moves needed to solve the problem increases exponentially as the number of disks increases.

meric symbols and 192 blank characters. Tile shapes are created and modified with an editor that uses the four arrow keys, and they may be placed anywhere on the screen in any combination of 16 background and foreground colors. Once placed, however, they are fixed in position. Characters are often used to create backgrounds for complex sprite scenes. They can also be used by themselves to create intriguing geometric patterns.

Music capabilities, available only in the newly released TI Logo II, are based on a three-voice music synthesizer. Using three voices you can play a three-part tune as a round or experiment with the various mathematical rules of harmony. Music commands can be synchronized with sprite animations to create a sprite ballet, for example, or music can be played continuously in the background while other actions occur independently.

Part 3 Three

Logo

At a Glance

	Developer	Distributor	Price*	Format	Computer
Apple Logo	Logo Computer Systems Inc.	Apple Computer Inc. 20525 Mariani Ave. Cupertino, CA 95014	$175.00	Two 5¼-inch floppy disks (Logo Language Disk plus backup)	Apple II Plus with 16K-byte RAM card or Apple IIe ($1875)
Atari Logo	Logo Computer Systems Inc.	Atari Inc. 1265 Borregas Ave. Sunnyvale, CA 94086	Under $100	Plug-in cartridge	Atari 400 ($299), 800 ($679), or 1200XL ($899)
Color Logo	Micropi Inc.	Radio Shack Education Division 1400 One Tandy Center Fort Worth, TX 76012	Program Pak: $49.95; floppy disk: $99	Program Pak or floppy disk	TRS-80 Color Computer with 16K-byte memory for Program Pak ($200); Color Computer with 32K-byte memory, Color Disk drive, and floppy-disk controller ($1048.95
Commodore Logo	MIT Logo Group and Terrapin Inc.	Commodore Business Machines Inc. 1200 Wilson Dr. West Chester, PA 19380	$99.95	Floppy disk (details to be announced)	Commodore 64 with Commodore 1541 floppy disk drive ($984)
DR Logo	Digital Research Inc.	Digital Research Inc. POB 579 160 Central Ave. Pacific Grove, CA 93950	Under $200	One nonprotected 5¼-inch floppy disk	IBM Personal Computer with 256K bytes of RAM one floppy-disk drive, and color graphics adapter ($2513); Texas Instruments Professional Computer (system requirements to be announced)
Krell Logo	MIT Logo Group	Krell Software Inc. 1320 Stony Brook Rd. Stony Brook, NY 11790	$89.95	Four 5¼-inch floppy disks (Logo Language Disk and backup, Krell Utilities Disk, Alice in Logoland tutorial disk)	Apple II Plus with 16K-byte RAM card or Apple IIe ($1875)
Terrapin Logo	MIT Logo Group	Terrapin Inc. 380 Green St. Cambridge, MA 02139	$149.95 (hard disk, $300)	Two 5¼-inch floppy disks (Logo Language Disk and Terrapin Utilities Disk); hard-disk version also available	Apple II Plus with 16K-byte RAM card or Apple IIe ($1875)
TI Logo II	MIT Logo Group and Texas Instruments Inc.	Texas Instruments Inc. POB 53 Lubbock, TX 79408	$129.95	Plug-in command module, sample programs on cassette or disk	Texas Instruments 99/4A with Peripheral Expansion Box, 32K-byte memory-expansion card, and cassette recorder ($870)

*Manufacturers' list prices are given for all hardware and software. Substantial discounts may be available through dealers.

Documentation	Special Features	User RAM Available
Apple Logo: An Introduction to Computer Programming Through Turtle Graphics; Apple Logo Reference Manual	Commands for burying and packaging procedures, automatic start-up file, property lists	14K bytes
Atari Logo: Introduction to Programming Through Turtle Graphics; Atari Logo Reference Manual	Four dynamic turtles (sprites) with collision-detection commands, simple music commands	Atari 400: 7.5K bytes; Atari 800: 17.5K–22.5K bytes
Color Logo manual, keyboard overlay; *TRS-80 Color Logo for Teachers* and *TRS-80 Color Logo for Parents* both optional prices and availability to be announced)	Up to 256 different turtles, ability to create new turtle shapes, Doodle Mode for single-key drawing, limited to turtle graphics (no list processing), networking capability using Radio Shack Network 2	16K-byte Color Computer: 9K bytes; 32K-byte Color Computer with disk drive: 20K bytes
To be announced	16 colors, Commodore graphics characters, 8 sprites, option command for system functions, assembly-language interface commands	14K bytes
Reference manual, introductory tutorial for adults	Expanded workspace, help command, debugging and workspace management commands, advanced list-processing commands, flexible text and graphics windows	192K bytes to 1 megabyte
MIT technical manual; Alice in Logoland Primer; large wall chart; sample copy of *Logo and Educational Computing Journal*	Assembly-language commands, utility for creating turtle shapes, rudimentary music commands, ability to save pictures on disk	11.5K bytes
MIT technical manual; Terrapin Logo tutorial	Assembly-language commands, utility for creating turtle shapes, rudimentary music commands, commands for Terrapin Turtle robot, ability to save pictures on disk	11.5K bytes
TI Logo by Harold Abelson; *TI Logo Curriculum Guide* optional, $49.95)	32 animated sprites, three-voice music synthesizer that can be combined with graphics commands, character graphics with built-in character editor	26K bytes

Limitations of TI Logo

The first limitation you encounter in TI Logo is that the turtle can draw lines on only about one third of the screen. This is because the turtle's lines are actually drawn using character graphics. When the 192 available blank characters are used up, an "OUT OF INK" message tells you that the turtle can't draw again until you clear the screen. While you can partially overcome this difficulty by carefully planning designs that fall within the allotted fraction of the screen, it's an unavoidable annoyance, especially for beginners. Exciting full-screen designs that can be drawn with other versions of Logo are not possible on this system.

Another serious limitation is that TI Logo can use only integer arithmetic, not taking advantage of the decimal arithmetic built into the TI computer. Therefore, TI Logo cannot carry out calculations such as those involving money, square roots, or trigonometric functions. Without decimal arithmetic, for example, it is impossible to create an accurate circle-drawing algorithm or to directly calculate the distance between two points on the screen.

TI Logo does not include commands to give you direct access to the computer's internal memory locations or to control external devices such as floor turtles. Similarly, because disk and cassette files are not directly available, you cannot store information while a procedure is in progress. TI Logo's designers may have seen these as "advanced" features not suitable for children, but their omission restricts the environments you might create for children.

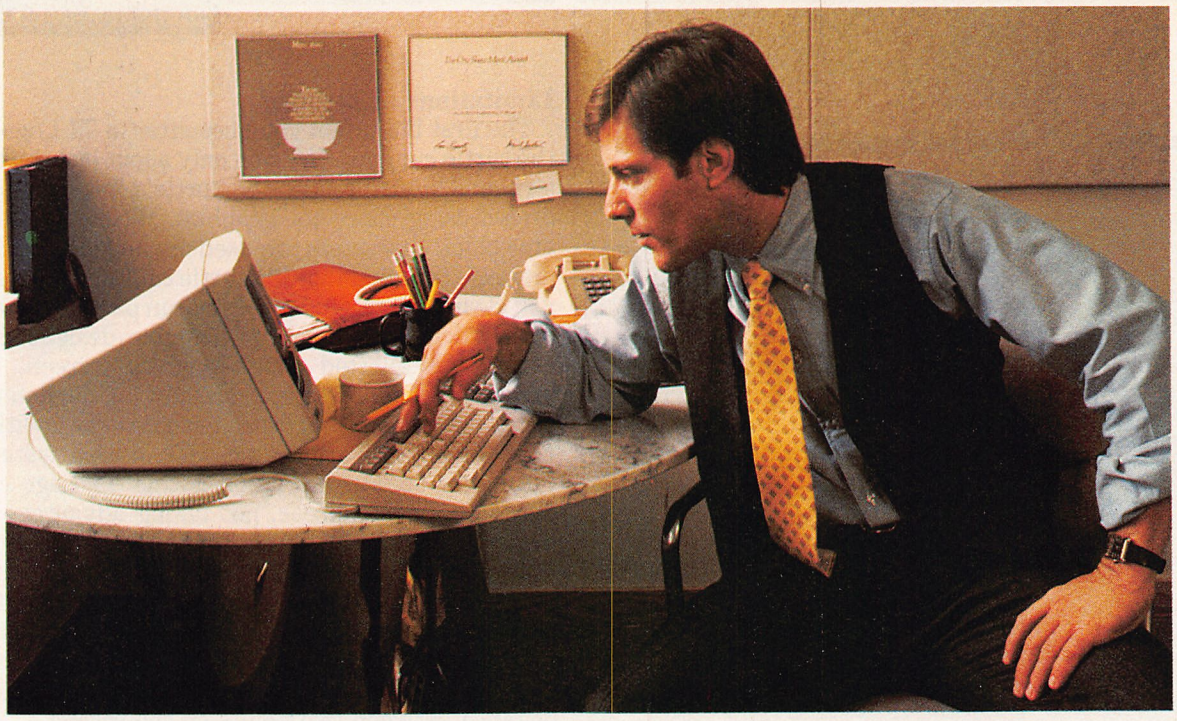
TI Logo Documentation

TI Logo's original documentation was extremely meager. It provided very few activities, very little sense of the power of Logo as a computer language or as a learning environment, and no information about list processing. Several list-processing commands were not even listed in the glossary.

The new documentation for TI Logo II, however, does much to remedy the situation. Harold Abelson's *TI Logo*, the language manual for TI Logo II, is a comprehensive overview of the language. Anyone using the original TI Logo will want to get a copy of this book. See "A Quick Logo Reference Guide" on page 162 for more books supporting TI Logo.

TI Logo Curriculum Guide is a text and software combination from Texas Instruments that offers many practical suggestions for teaching the use of specific Logo commands and includes a complete glossary of commands. The software part of the *Curriculum Guide* is a series of preprogrammed activities—software written in Logo that allows children as young as four or five to manipulate sprites and draw with the turtle using single-key commands.

Unfortunately, though, the *TI Logo Curriculum Guide* misses the broader point of what Logo is all about as it implies that the system should be taught as a sequence of commands. In my opinion, the best way



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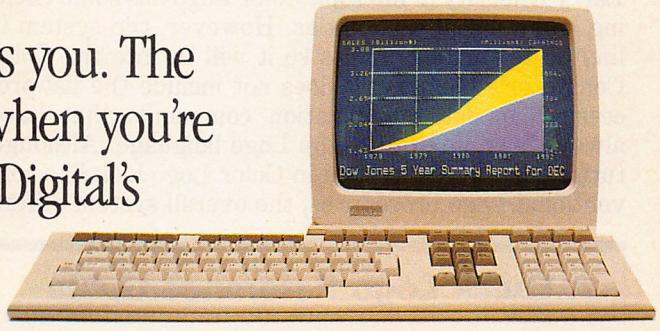

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for children to learn Logo is through a series of projects that they themselves conceive and carry out with the help of a knowledgeable parent or teacher. Although the guide contains a good deal of practical information that could help someone teach Logo, I would not recommend using it literally as a curriculum. Also, by combining software and activities for very young children with information for teachers of older children, TI has made the total package cost more than teachers of either group will want to spend.

Color Logo

Color Logo for the TRS-80 Color Computer is a turtle graphics language based on many of the ideas in Logo. Created for Radio Shack by George Gerhold and Larry Kheriaty of Micropi, Color Logo has some exciting and unusual capabilities. However, the system is limited to turtle graphics so it will fit into the Color Computer's memory; it does not include the list-processing or data-manipulation commands that have always been integral to the Logo language. Although turtle procedures written in Color Logo look like conventional Logo procedures, the overall system differs in many ways from standard versions of the language.

While I can't really quarrel with the decision to limit Color Logo's capabilities, I do wish that the product had been given another name. The name Color Logo may mislead some purchasers into thinking that they are getting a version of Logo that is comparable to other implementations. If you're in the market for an inexpensive Logo system, I cannot recommend a Color Computer with Color Logo. Too many of Logo's standard features are missing from this implementation. If you already own a Color Computer, however, I do recommend it. Despite its limitations, it's the most exciting and versatile educational software available for the Color Computer.

Special Features

Color Logo has four operating modes: Run, Edit, Break, and Doodle. In Run you can give commands to the turtle. In Edit you create or edit procedures. Break is used to move between Run and Edit, to save procedures on a disk or cassette, or to print them with a printer. Doodle allows young children to create turtle drawings by pressing single keys.

A Quick Logo Reference Guide

Logo books and curriculum materials are being published at such a rapid rate that this list is bound to be incomplete by the time you read it. Our listing includes brief descriptions of all the books that we have actually seen. If the material is not yet available, the publication date is given in parentheses.

Abelson, Harold. *Logo for the Apple II* and *Apple Logo*, New York: BYTE Books/McGraw-Hill, 1982 (*TI Logo*, late fall 1983). A comprehensive overview and reference manual for the Logo language; it contains many program examples at all levels.

Abelson, Harold and Andrea diSessa. *Turtle Geometry*, Cambridge, MA: MIT Press, 1981. A college-level mathematics text for serious mathematicians and fans of recreational mathematics. This book proves that turtle graphics is not just kids' stuff.

Albrecht, Bob and Ramon Zamora. *Teach Yourself TI Logo*, New York: BYTE Books/McGraw-Hill, (fall 1983). A whimsical introduction to TI Logo for children featuring sprites and turtle graphics.

Beardon, Donna. *One, Two, Three, My Computer and Me: A Logo Funbook for Kids*, Reston, VA: Reston Publishing Company, (1983).

Beardon, Donna, Kathleen Martin and Jim Muller. *The Turtle's Sourcebook*, Reston, VA: Reston Publishing Company, (1983). Originally distributed by the Young People's Logo Association, this book contains a large collection of turtle graphics activities in worksheet format. Some other activities are also included.

Bitter, Gary and Nancy Watson. *Apple Logo Primer*, Reston VA: Reston Publishing Company, (1983).

Burnett, J. Dale. *Logo: An Introduction*, Morristown, NJ: Creative Computing, 1983. A short collection of Logo explorations primarily in the areas of mathematics and turtle geometry.

BYTE, Logo Issue, August 1982. This issue features several articles by Logo specialists including Harold Abelson, Paul Goldenberg, Brian Harvey, Robert Lawlor, Cynthia Solomon, and Dan Watt. Practical as well as theoretical articles are included.

Goldenberg, E. Paul. *Special Technology for Special Children*, Baltimore: University Park Press, 1979. This work describes the use of computers with special-needs children, focusing especially on Logo.

Minnesota Educational Computing Consortium (MECC). *Apple Logo in the Classroom*. MECC Distribution Center, 2520 Broadway Dr., St. Paul, MN 55113. A structured Logo curriculum featuring a series of activities (mostly turtle graphics) for

Color Logo has some unique features. As many as 256 different turtles can be at work on the screen at any one time, and these turtles can send each other numerical messages called *mail*. Once such a message is received, the procedure controlling the actions of the turtle that received it can use it as an input. Because you will need to master some complex rules of precedence to write procedures for multiple turtles, this qualifies as an advanced feature of Color Logo.

Color Logo also features the SHAPE command, which lets you define new turtle shapes. Using SHAPE you can create animations in which a turtle takes on a series of shapes or games in which different turtles take on different shapes and roles. Although this allows for some interesting projects, it is not easy to use. Because Color Logo does not have a shape editor, you must specify the shapes with a long series of letters. Therefore, the Color Logo manual suggests that you work out the design of a new shape on graph paper before typing in the needed string of letters.

Doodle mode, a third special feature of Color Logo, lets you draw with the turtle using single-key commands. Doodle drawings automatically become procedures that can be executed from the Run mode. You can also transform these into regular Color Logo procedures or into shape definitions, but this requires a rather complex translation process. Doodle is a nice introductory activity for young children; in other versions of Logo you have to create special procedures (found in many Logo programming texts) to accomplish the same thing.

Color Logo's screen editor deserves special mention because I find it more difficult to use than other Logo editors. Rather than giving you one procedure at a time, all the procedures that you define during a session remain in the editor at once. This makes it awkward to edit a single procedure because you must first locate the one you want to edit. Because the cursor always stays on the bottom line of the screen and the text itself scrolls up and down, you face the problem of not being able to see any lines below the one you are editing.

However, one especially nice feature of the Color Logo editor is not available with other versions of Logo: you can indent text. Indentations make complex procedures easier to read and understand because they can be displayed in a structured format. Other versions of Logo remove all extra spaces from a procedure definition, making it much harder to read.

A final special feature of Color Logo is that it can be incorporated in a computer network using Radio Shack's Network 2 system. This would allow as many as 16 users with the Program Pak version to access a single 32K-byte Color Computer running the floppy-disk version of Color Logo.

Bugs and Limitations

In addition to being limited to turtle graphics, Color Logo has a number of annoying inconsistencies and bugs that interfere with its ease of use. In regard to Color Logo's graphics capabilities, for example, the turtle itself can appear in only 8 different orientations. This produces a disconcerting effect: the turtle often moves in a direction different from its apparent heading. Furthermore, the turtle doesn't always move in the direction it is supposed to if its steps are small. Another problem occurs when the turtle goes off the screen and wraps around to the other side; in this case, it draws *no lines at all*, making it extremely difficult to understand what has happened. When the turtle wraps from the top of the screen into the text area at the bottom, an extra turtle unexpectedly appears at the bottom of the screen.

Error messages in Color Logo are also confusing. For example, the unworkable command FORWARD XXX gives you the error message "I DON'T KNOW HOW MUCH" while the similarly faulty command PRINT XXX gives you no error message at all. Worse, typing an extra FORWARD by accident, as in FORWARD FORWARD 50, causes an extra turtle to appear on the screen! But the strangest result I got came in response to the erroneous command PRINT

children in grades 5 through 9, accompanied by a teachers' manual.

MIT Logo Group. *Bibliography of Logo Memos.* MIT Artificial Intelligence Laboratory, 545 Technology Square, Cambridge, MA 02139. This bibliography offers capsule descriptions of over 60 available publications describing more than a decade of Logo research at MIT.

Papert, Seymour. *Mindstorms: Children, Computers and Powerful Ideas*, New York: Basic Books, 1980. Logo's principal developer and advocate presents an exciting overview of the philosophy of Logo and the ideas that went into it.

Thornburg, David. *Discovering Apple Logo*, Reading, MA: Addison-Wesley, (1983). A collection of turtle geometry projects offering an intriguing look at the relationship between turtle geometry and some powerful mathematical concepts embodied in natural systems.

Watt, Daniel. *Learning With Logo* and *Learning With Apple Logo*, New York: BYTE Books/ McGraw-Hill, 1983. A hands-on guide for kids and adults featuring introductory to intermediate projects and including interactive games and list processing. Also available in late 1983 or early 1984: *Learning With TI Logo*; *Learning With Atari Logo*; and *Learning With Commodore Logo.*

HEADING. This caused an error message to appear on the turtle's part of the screen rather than in the text area where error messages usually appear. When I typed other commands the entire turtle screen started scrolling upwards and never returned to a normal state until I pressed the Break key. It's clear that the program was not fully tested and debugged before its release.

Some other limitations make Color Logo harder to use than its competitors. Certain commands such as REPEAT or MAKE can be used only in procedures, not directly in the Run mode. This makes many simple exploration and debugging activities very awkward. Another problem is that you cannot stop the action of a program without pressing the Break key, which removes the image from the screen. Because error messages do not identify the line of a procedure that is in error (or even the procedure itself), finding errors and debugging them is much more difficult than in other versions of Logo.

Documentation

The authors of Color Logo have done a nice job with its documentation, producing a clear and comprehensive 136-page manual. This manual offers a good introduction to Color Logo for adults who may have little or no computer experience. The authors provide many examples of turtle procedures, and they never forget that the goal of Logo is to encourage users to explore on their own as much as possible. A complex game near the end of the book shows what can be done with multiple turtles, turtle shapes, and messages, although beginners will probably need to see more examples of these things before they can use them easily. An unusually helpful feature of the manual is that it clearly describes the system's limitations.

Because the Color Logo manual is not written for children, a good children's introduction to Color Logo is needed. Teachers or parents using Color Logo will also need much more information about teaching Logo in order to be effective. Radio Shack plans to introduce materials for teachers and parents soon, but until such books are written, you can generally get by with books for other versions of Logo if you keep in mind the differences between versions.

Coming Attractions

Several more versions of Logo will be reaching the market this summer or fall. I've been able to obtain prerelease software and advance information about three of them: Commodore Logo for the Commodore 64, Atari Logo for the Atari 400, 800, and 1200XL, and DR Logo for the IBM Personal Computer. Several other versions of Logo will be out later this year or early next.

Commodore Logo

Commodore Logo (for the Commodore 64 computer with one disk drive) is based on the version of Logo originally developed for the Apple II at MIT and is being produced by Terrapin Inc. In general, it stacks up well against versions of Logo for the Apple. Commodore Logo offers 29 percent more user memory than Terrapin's Apple version, includes all standard Logo capabilities, and has some features unique to Commodore. Many procedures written for Terrapin's Apple version will run without modification in Commodore Logo.

Commodore Logo's graphics options provide some nice flexibility. In addition to high-resolution turtle graphics with 16 foreground and background colors, you can use all 66 of the Commodore 64's graphics characters. Text and graphics can be mixed either by printing text characters on the turtle screen or by increasing the size of the text window at the bottom of the screen.

A more advanced .OPTION command allows you to change some of the ways that the system operates. (Logo command names that begin with a period are traditionally reserved for advanced features that are used infrequently.) One option allows you to store text on a disk directly from the Logo screen editor so that you can use the editor for writing simple letters or stories. Another option lets you set the default colors used for the turtle's pen and the background to the ones that look best on your own particular TV or monitor.

Speaking of colors, I have to say that I find Commodore Logo's colors a bit disappointing. Although the system allows 16 foreground and background colors, many color combinations just don't look good. This is especially apparent with text colors—most text/background color combinations are simply unreadable. To be fair to the developers of Logo, I would fault the Commodore 64 itself rather than this version of Logo.

You may experience some frustration with the keyboard when you use Commodore Logo for the first time, especially if you're working with young children. The keyboard has so many options that it's easy to become confused.

I was disappointed that my preview version of Commodore Logo did not include commands for the Commodore 64's three-voice music synthesizer or its sprite graphics capabilities. According to Jock McClees, president of Terrapin Inc., commands for controlling 8 sprites are being added to Commodore Logo and will be included by the time the product is released this summer. Assembly-language routines for the music synthesizer and for a sprite shape editor will be provided on a separate utilities disk.

Documentation for Commodore Logo will be similar to that provided with Terrapin's Apple version: an informative, simple Logo tutorial limited to turtle graphics and a technical manual designed primarily for Logo experts experienced in assembly-language programming. Fortunately, ordinary Logo users can refer to books written for other versions of Logo while awaiting more specific publications.

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Atari Logo

Atari Logo, scheduled for release sometime this summer, will be sold as a plug-in cartridge for the Atari 400, 800, and 1200XL. Developed by Logo Computer Systems Inc. of Montreal, the system is a full version of Logo that includes most of the features of Apple Logo. The best news of all is that Atari Logo will run on an Atari 400 with as little as 16K bytes of RAM and requires no disk drive or memory extensions.

Atari Logo has some nice graphics capabilities and even a set of rudimentary music commands. It provides four dynamic turtles that are a cross between conventional turtles and sprites. Like sprites, dynamic turtles can move freely across the screen and take on different shapes and colors. Like turtles, they can draw lines as they move. Because Atari Logo includes a command that can detect the collision of two turtles or whether a turtle crosses a line of a certain color, it is suitable for programming simple video games. Unlike other versions, the Atari Logo turtle looks like a turtle, which is very attractive (although it is a bit difficult to tell just where the turtle's center is located and where it is heading).

Digital Research's Logo may prove powerful enough for program development and AI research.

Some compromises had to be made to fit Atari Logo into a 16K-byte cartridge. The screen resolution is not as sharp as in other versions of Logo, but the colored lines do look crisp and clear against the background. Because the turtle changes its apparent heading in 15-degree increments, the turtle's apparent orientation doesn't always match the direction it actually moves. The other major casualties of limiting the system are Apple Logo's BURY and PACKAGE commands and property-list commands. Standard list-processing commands are part of the system, though.

DR Logo

The latest entry in the Logo sweepstakes is DR Logo for the IBM Personal Computer and the Texas Instruments Professional Computer. Developed by Digital Research Inc., DR Logo is a new kind of venture for the company, which is known primarily for the CP/M operating system and other business-oriented software. DR Logo has been a personal project of Gary Kildall, Digital Research's founder and the developer of CP/M (see "The Digital Research Story," *Popular Computing*, February 1983, page 109). Because it includes some unusual advanced features and takes advantage of the much larger memory of 16-bit computers (anywhere from 192K bytes to 1 megabyte of RAM according to Kildall), Digital Research's version may turn Logo into a "serious" programming language for applications development and research and training in artificial intelligence.

According to Kildall, DR Logo will include turtle graphics, list processing, and all the other traditional features of Logo. Its built-in help function will describe each Logo command and give an example of how it is used, and more importantly, it will have powerful features for organizing and debugging complex projects. You'll be able to trace procedures while they are running and to cross-reference procedures that have already been defined. This sophisticated system will also include a number of mathematical functions needed for scientific programming as well as arithmetic capabilities that are more accurate and complex than those in other versions of Logo.

Given these advanced features, Kildall expects DR Logo to attract a much more sophisticated audience than other versions have. He feels that its high-resolution color turtle graphics will make it useful for business applications, for example. He also hopes that its souped-up list-processing and debugging capabilities will attract the attention of artificial intelligence researchers. DR Logo has most of the capabilities of LISP, the language most commonly used in such research, but because it is easier to use, it may find a place in introductory AI courses at colleges and universities.

Even More Logo

The Lisp Company of Los Gatos, California, has developed a version of Logo for the brand-new Aquarius color computer from Mattel Electronics. According to John Allen of The Lisp Company, this version of Logo includes a full set of list-processing and decimal arithmetic commands as well as multiple turtles and animation capabilities. The retail price of the Aquarius is about $150, and the Logo cartridge itself will sell for less than $100 when it becomes available this summer.

Several other versions of Logo are being developed and should be available in the next year. Most of these are being produced by Logo Computer Systems Inc. (LCSI), which has officially announced versions for Digital Equipment Corporation's Pro Microcomputer and the Sinclair Spectrum.

For the many Apple users interested in sprite animation, LCSI has produced a Sprite Logo for the Apple II that includes a sprite graphics board as well as Logo software. As of this writing, arrangements for distribution of Sprite Logo have not been finalized, but the price should be around $300.

Finally, just as we were going to press, Harvard Associates of Somerville, Massachusetts, announced another version of Logo for the IBM Personal Computer. PC Logo will run on a Personal Computer with 64K bytes of RAM, will cost $199.95, and should be available in July 1983. □

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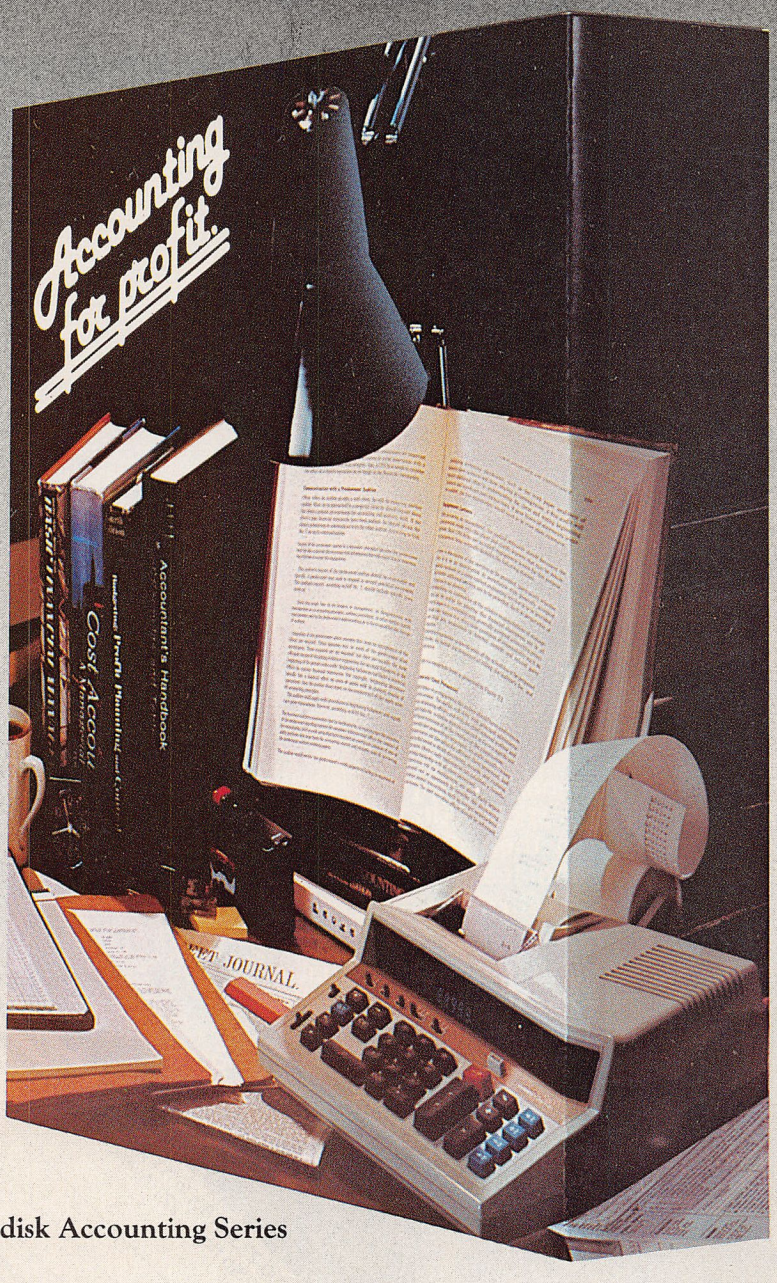

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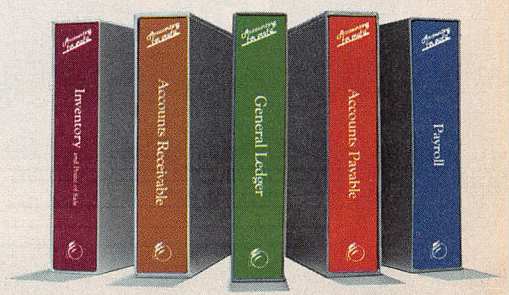

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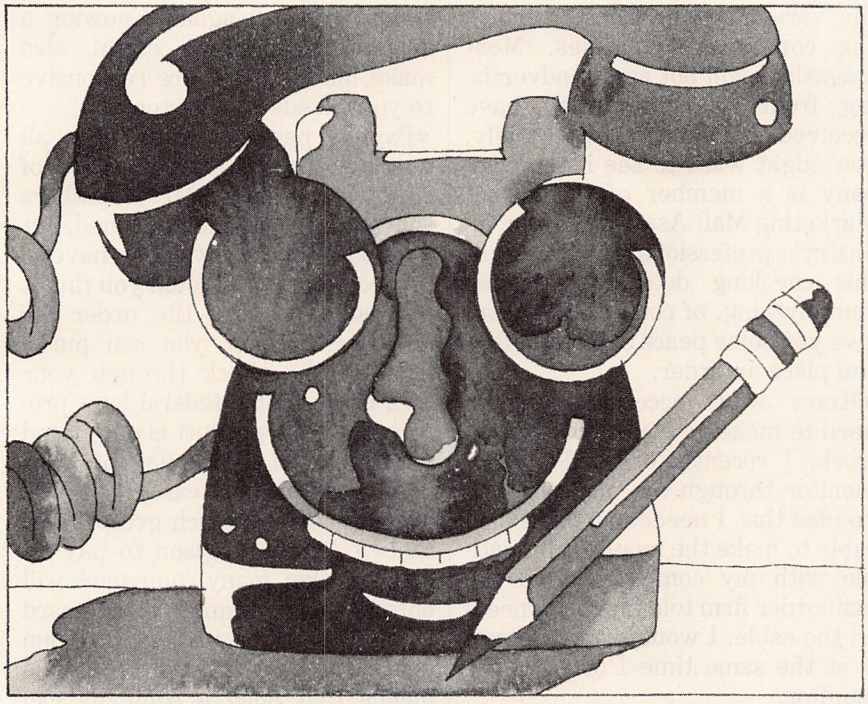


A Survival Kit for Mail-Order Buying

To buy through the mail or not to buy through the mail—this is a dilemma many of us face frequently. Obviously, the biggest advantage to mail-order buying is lower prices. Computer magazines are filled with advertisements for that printer, monitor, or software package that you can order for a price lower than you'll get from your local dealer. Depending on how much you buy from any one firm, you can often get 30 to 40 percent off the list price, and you get a virtually unlimited selection of products in the bargain.

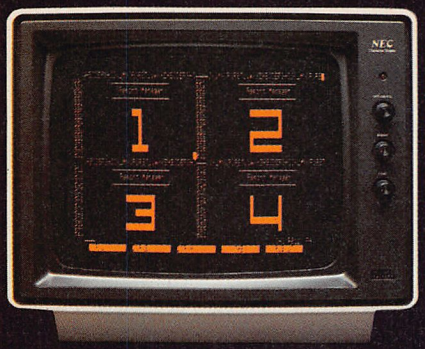
But should price and selection be the deciding factors? Millions of people buy through the mail with great satisfaction, but there are some potential problems that you should be aware of. Besides the usual drawbacks involving shipping damage and late deliveries, it is difficult to develop a personal relationship with a mail-order company as you can with a local dealer. Many sales representatives from mail-order companies are very helpful, but few will call you when a product you want comes in or provide other personalized services of the sort a good dealer is known for.

Also, questions concerning quality and availability of service always come up, and for good reason. People hesitate to ship their computer equipment back for repairs and would rather have the work done close to home with minimum downtime. With most local dealers offering service departments and loaner programs, they clearly have the advantage over mail-order firms when it comes to service.

Buying through the mail *can* be a convenient, easy, and reliable way to purchase everything from a minicomputer to a $2.50 storage box for your disks, but it can be a hassle as well. If you decide to deal with a mail-order firm, here are some suggestions on how to avoid the hassles:

•Know exactly what it is that you want to order before you call any company. Try to find the model you want in a local store or a catalog and record the model number and any other information that you might feel is important (such as

Illustration by Patrick Blackwell



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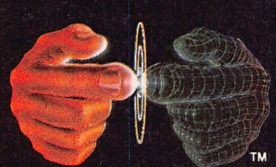

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memory capacity, weight, documentation, and so on). Try to avoid shopping over the phone—don't let the people on the other end make your decisions for you. It's fine to ask questions and get suggestions as to what might be your best choice, but remember that you know your needs best and are the only one in a position to make the final decision.

•Check the company out. If you have doubts about a company, contact its local Better Business Bureau to inquire about complaints. You can also check with the various publications in which the company advertises. Most magazines will not accept advertising from companies they have received complaints about. Finally, you might want to see if the company is a member of the Direct Marketing Mail Association, the industry's professional group. All of this checking doesn't guarantee you anything, of course, but it can give you some peace of mind before you place an order.

•Know what accessories you'll need to make your new acquisition work. I recently ordered a color monitor through the mail and had no idea that I needed an additional cable to make the monitor compatible with my computer. Had the mail-order firm told me that I needed the cable, I would have ordered it at the same time I ordered the monitor.

•Confirm your order. Call the company you ordered from a day or two after you've placed your order to confirm the sale. Even though your order was taken, the item you want may be back-ordered because it is not in stock. If you are in a hurry to get the product (and many mail-order firms stress their quick shipping), you might want to call another company.

When I ordered my monitor, almost ten days passed before I called back only to learn that it was back-ordered and that it would be at least another two weeks before it could be shipped. Responsible companies should let you know this when you order so you can decide whether you're willing to wait. Your best bet is to check the status of what you order while you are still on the phone with the salesperson.

•Get the name of the person who takes your order. Most companies are very busy and growing at an incredible rate. Knowing whom you spoke with will help you locate that person again should you have any questions about the status of your order. In addition, many sales representatives work on commission and want you to speak with them should you call again. Knowing a salesperson's name might also make him or her more responsive to your needs as a customer.

•Pay by personal check if at all possible. In this day and age of credit cards and toll-free numbers this might sound old-fashioned, but it's about the only way you have to protect yourself. Should you find it necessary to stop the order for whatever reason, you can put a hold on the check through your own bank. (Some federal laws protect you if the product is purchased within 50 to 100 miles of your home, but in most cases you'll be ordering over a much greater distance.) Another reason to pay by check is that many companies will enter a charge against a credit card when you order instead of when your purchase is shipped. This means that such a company can have your money for weeks before a back-ordered item is shipped.

•Ask for the total cost of all the products you order. If you are mail-ordering from out of state, there should be no local or state sales taxes. There will be a shipping charge (this usually depends on how you want your purchase shipped) and perhaps an extra charge for insurance. Finally, most companies will add a surcharge if you use a credit card. This extra charge helps cover the percentage the company has to "refund" to the charge company. Don't be surprised later when you get your bill. Ask up front.

•Ask for the particulars of the warranty even if it is printed in the advertisement. Warranties differ dramatically from company to company. Be sure that you understand the conditions and ask the company to send a written copy of its warranty along with your order.

•Check the contents of your package as soon as you receive it. If anything is missing or broken, call the company immediately. Be sure to save any packaging materials— the shipper usually will want to verify the condition of the package when you received it. If you do have to return something, always contact the company *before* doing anything. The company will give you explicit instructions on how to return a product and usually assign you a return number to place on the package. If you must return products, ask about reimbursement for your shipping and insurance costs. —Neil J. Salkind

Using Your Micro for Telex Services

It all started on a trip to the Far East. Our company was considering going into the monitor business, and I was shopping in Korea, Taiwan, and Japan for products. Every company I talked with wanted to know our Telex number, and I found myself repeatedly explaining that we didn't have one. I was greeted with many sad shakes of the head as one manufacturer's representative after another concluded we weren't even a real company if we didn't have a Telex machine.

Back in New York after the trip, we gathered together all the information I'd brought back and put together our requests for quotations. As time was a critical factor, we decided to send telegrams to each of 19 companies I'd contacted. The telegrams cost a fortune, and again, many of the responses I got by mail and telegram demanded to know our Telex number so the companies could forward product and pricing information overnight.

At this point it was obvious we needed a Telex machine. But after checking into installation and equipment charges, we wondered if it might be cheaper just to fly to the Orient and talk with our suppliers face-to-face.

Sending Messages via Telex

Telex service, if you aren't familiar with it, uses a sort of Teletype machine that sits in your office and is connected to a dedicated telephone line assigned to your Telex number. In the receive mode, the machine automatically answers the phone, responds to an inquiry with an "answerback" which confirms that the sender has reached the right company, and accepts an incoming message. Then the machine hangs up the phone and waits for another message.

To send a message, you first compose the message, usually with a paper-tape punch (although some of the more modern machines use magnetic media), and then dial up the Telex number of the company you want to send your message to. When you've established contact with that company's machine, the paper tape is run through your machine, read into the phone line, and transmitted to the receiving machine.

The advantages of Telex service in commerce are enormous. For product information, price quotes, and contractual arrangements or modifications, you're provided with hard copy—a written, error-

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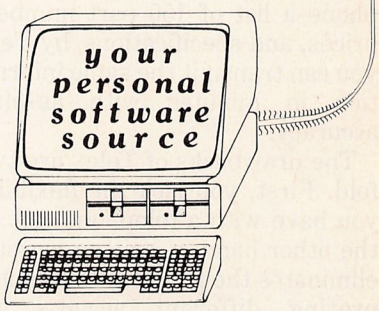

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free copy of the interaction or transaction. And while it can take hours to carefully read over the phone a list of 150 part numbers, prices, and specifications, by Telex you can transmit the same information in minutes with absolute accuracy.

The drawbacks of Telex are twofold. First, you lack the flexibility you have with a telephone call. On the other hand, a written message eliminates the problem of misinterpreting different accents and avoids the costly need for you and others to repeat what you're saying. Second, you have to pay a rental charge for Telex equipment, which can range from $25 per month (with some of the discount houses that install older, used equipment and service only major metropolitan areas) to more than $125 per month (to go first-class with Western Union). When you include the cost of a dedicated phone line, the hassle of getting the whole system installed, and the space one of these big machines takes up, you can see that Telex probably isn't all that useful unless you're doing a great deal of international communications.

Now, however, if you have a microcomputer, modem, and communications software, you can get all the benefits of Telex service with virtually none of its disadvantages. Using the new computerized system from RCA Global Communications called Direct Distance Dialing, you can send and receive real-time Telex or TWX messages anywhere in the United States or the world through your computer terminal, for the cost of the connect time only (usually ranging from $2 to $3 per minute for international messages). RCA charges no sign up, rental, or other fees.

RCA also offers a store-and-forward service at no extra charge (other than usage time), which means that your computer doesn't have to be online all the time, thus freeing up both the computer and the phone line. You dump a message into the forwarding computer at RCA headquarters, and that computer sends the message on to its destination.

When the receiving party responds to your Telex, it dials up your number, and the RCA computer answers the phone, "pretending" that it's you by responding with your answerback code. The party that's calling you sends its message to the RCA computer, which then stores the message in a data bank until you dial up your "mailbox" to get your messages.

How to Use Direct Distance Dialing

Once you get the hang of it, using RCA's Direct Distance Dialing service is simple. The communications protocol is 300 bits per second (a faster rate is available, but 300 is recommended), asynchronous, half-duplex, 7- or 8-bit words (RCA's computer ignores the eighth or parity bit), null parity. You must also send a linefeed after a carriage return, as RCA's system doesn't recognize the two together as one code as many systems do.

To sign up for RCA's Direct Distance Dialing, simply call (800) 526-3969. The company will assign you an answerback code and password, and in about three weeks you'll be logged on to its computer and will get a call with your new Telex number. You'll also receive a sticker to put on the side of your computer with the two 800 numbers to access the real-time and store-and-forward services of Direct Distance Dialing. Most businesses that use personal computers will probably opt for the store-and-forward service only. With this service, the RCA computer emulates your computer so you can receive incoming messages 24 hours a day without tying up your phone lines and computer.

To access the store-and-forward service, call the 800 number you've been assigned, and when you hear the tone, switch on your modem. After a few seconds and two "nothing done" messages (where the RCA computer is expecting an opening protocol from one of its own terminals), you'll be prompted with the message YR ID PLS? Type in your Telex number, a single space, your four-letter answerback code, a single space, and the letters UR.

The computer will then print a reference line consisting of the time, date, and a reference number, which you use for any messages you send in this session. Following the reference line, the computer will print GA MSGS, which is short for "Go ahead and send your messages." At this point, you can either send a message or check your mailbox.

To send a message, type in the Telex number of the party you want to send a message to (preceded by the three-digit country code—these codes are not the same as the Bell codes, so be sure to request a directory when you sign up), followed immediately by a + and a carriage return. Then type in the text of your message (or dump a prewritten file, if your communications package allows).

At the end of your message, enter a carriage return followed by five periods and carriage return. The computer will respond RCVD 234567 (your number) TIME: 1045 EST. To sign off, send another string of five periods, and the computer will automatically log you off.

To get your messages, follow the above procedure until you get the GA MSGS prompt. At that point, send a string of five capital Ls followed by a carriage return. The computer will then ask you for the function you're requesting with PLS ENTER COMMAND. (Right now, mail is the only option—more may be offered later.) At this point you enter MAIL and press the carriage return.

The computer will then request your password with ENTER PASSWORD. You type in the five-letter password you've been assigned (or chose), and the computer will then send along to you all your mail, any messages from RCA, and delivery confirmations

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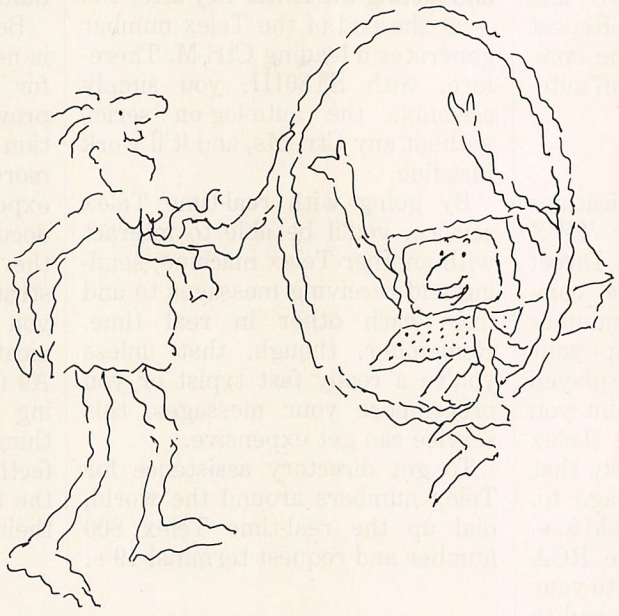
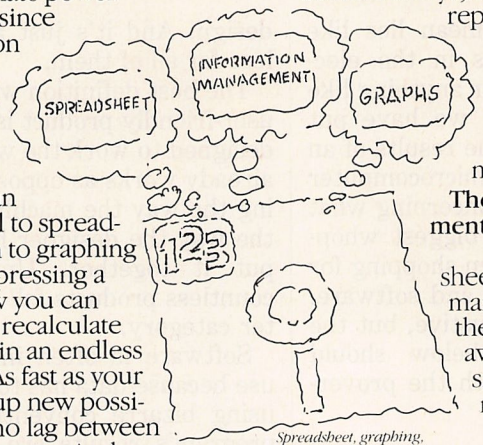


Meet 1-2-3 – the remarkable new software package that puts more raw power at your finger tips than anything yet created for the IBM PC. 1-2-3 actually combines information management, spreadsheet, and graphing in one program that can perform all three functions interchangeably and instantly at the touch of a key. That's power.

To explain: since 1-2-3's information management, spreadsheet and graphing functions reside in memory simultaneously, you can go from retrieval to spreadsheet calculation to graphing instantly, just by pressing a few keys. So now you can experiment and recalculate and look at data in an endless variety of ways. As fast as your mind can think up new possibilities. There's no lag between you and the computer. And that's a new kind of power – power that's greater than the sum of its programs.



Spreadsheet, graphing, information management all-in-one.

The spreadsheet function.

If 1-2-3 were just a spreadsheet, you'd want it because it has the largest workspace on the market (2048 rows by 256 columns). To give you a quick idea of 1-2-3's spreadsheet capabilities: VisiCalc's spreadsheet for the IBM PC offers 15 arithmetic, logical and relational operators, 28 functions and 32 spreadsheet-related commands. 1-2-3 has 15 operators, 41 functions and 66 commands. And if you include data base and graphing commands, it actually has 110!

In addition, 1-2-3 is up to 50 times as fast as established spreadsheets. With all the features you've ever seen on spreadsheets. 1-2-3 also gives you the capability to develop customized applications (with 26 macro keys) and lets you perform repetitive tasks automatically with one keystroke. If 1-2-3 were just a spreadsheet, it would be a very powerful tool. But it's much, much more.

The information management function.

Add to 1-2-3's spreadsheet a selective information management function, and the power curve rises at an awesome rate. Particularly since 1-2-3's information management capability reads files from other programs such as WordStar, VisiCalc and dBase II. So you can accumulate information on a limitless variety of topics and extract all or pieces of it for instant spreadsheet analysis. Unheard of before. Specific 1-2-3 information management features include sorting with primary and secondary keys. Retrieval using up to 32 criteria. 1-2-3 performs statistical functions such as mean, count, standard deviation and variance. It can produce histograms on part or all of the data base. 1-2-3 also allows for the maintenance of multiple data bases and multiple criteria.

The graphing function.

1-2-3 enables you to create graphs of up to six variables using information already on the spreadsheet. And have it on screen in less than two seconds! Once you've made a graph, three keystrokes will display it in a different form. If data on the spreadsheet changes, you can display a revised graph with one keystroke. This instant relationship of one format to another opens up a whole new application area. For the first time graphics can be used as a "what if" thinking tool!

For a full demonstration of 1-2-3's remarkable power, visit your nearby 1-2-3 dealer. For his name and address, call 1-800-343-5414 (in Mass. call 617-492-7171).

Lotus Development Corporation, 55 Wheeler Street, Cambridge, MA 02138.

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on any Telex messages you may have recently sent.

At the end, the computer will prompt you with END OF MAIL, YR ID PLS?, THANK YOU, and PLS ENTER COMMAND. Repeat the five periods to exit the computer, and you'll be logged off automatically.

Real-Time Conversations

For real-time communications with any other Telex or TWX machines, call up the RCA Direct Distance Dialing real-time computer (the second 800 number you're given) and hook up your modem. RCA GA will be displayed on the screen, at which point you enter the number of the Telex machine, country code first, that you want to send a message to. Following the number, you add a +.

Within a half second, the RCA computer will send a Ctrl-E to your computer. You have one second to respond to this signal with your Telex number, answerback code, and a UR. Because of the tight time restraints, your microcomputer must be able to emulate a Telex machine fully, which means you must have a communications package that can respond to that Ctrl-E inquiry within one second by transmitting Ctrl-J, Ctrl-M, 123456 (your Telex number), a space, LSIS (your four-letter answerback code), a space, UR, Ctrl-J, and Ctrl-M. (If you're still having problems with this procedure after two tries, you'll have the option to answer manually.) Crosstalk (from Microstuf Inc., Suite 205, 1845 The Exchange, Atlanta, GA 30339) and Teletalk (from Datasoft, 9421 Winnetka Ave., Chatsworth, CA 91311) are two software packages that work in this real-time mode, the former for the IBM Personal Computer and other CP/M machines, the latter for Atari computers.

With the ST80III program I use on my TRS-80 Model III, I had to eliminate the Ctrl-Ms from the series because ST80III automatically sends a two-second pause after a carriage return (Ctrl-M), which would cause the RCA computer to hang up. The program, however, adds the trailing Ctrl-M, and hitting the Enter key after the + at the end of the Telex number generates a leading Ctrl-M. Therefore, with ST80III, you simply assemble the auto-log-on series without any Ctrl-Ms, and it'll work just fine.

By going with real-time Telex service, you'll be able to interact with another Telex machine, sending and receiving messages to and from each other in real time. Remember, though, that unless you're a really fast typist or you precompose your messages, this service can get expensive.

To get directory assistance for Telex numbers around the world, dial up the real-time Telex 800 number and request terminal 19+. You'll be connected to an information operator whom you'll interact with in real time through your keyboard and who can look up the numbers you need.

Because Direct Distance Dialing is new and has never been offered for microcomputer users, RCA provides virtually no documentation yet. As the service becomes more popular and widely known, I expect RCA will publish complete documentation. But fortunately, the whole process is extremely straightforward and simple, once you master the protocol of communicating with the RCA computer. As for me, after a little handholding from the salesperson, everything was (and is) working perfectly, and our company has joined the big leagues of businesses with their own Telex numbers.

—Thomas C. Hartmann

The Six Biggest Lies in Personal Computing

No, we don't mean lies like "the check is in the electronic mail" or anything like that. Rather, what we have put together here are the results of an informal survey of microcomputer dealers and users concerning what they think are the biggest whoppers you'll hear when shopping for computer hardware and software. The list is not exhaustive, but the six claims listed below should always be taken with the proverbial grain of salt.

•*It's user-friendly.* It very well might be—if someone could define what "user-friendly" means. Calling a product user-friendly (or easy-to-use, easy-to-learn, simple, and so forth) is a standard claim today. It's used to describe not only software, but also manuals, operating systems, hardware, and system design. And it's just as meaningless for all of them.

The best definition we have for a user-friendly product is one that is designed to work the way the user already works as opposed to working the way the machine works or the way the designer happened to put it together. Unfortunately, countless products fall into the latter category.

Software is often impossible to use because data has to be entered using bizarre conventions or the program's results are indecipherable. Hardware is sold with unusably small screens, uncomfortable keys, odd keyboard layouts, or inaccessible switches.

Manuals are a particularly sore point. Writers often describe products in a way that forces you to adopt their own particular approaches. Hardware documenta-

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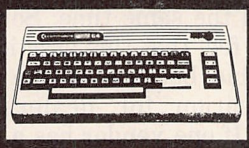

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tion often seems to be written by authors who are fluent in a variety of different languages but not, alas, in English.

Operating systems are another major problem. The accountants who are used to working with spreadsheets are now forced to work through another layer in what is essentially a foreign language. The ideal operating system is one that is invisible to the user or at least prompts the user in English.

Poorly designed systems induce back pain from awkward typing positions, headaches from noisy, screeching printers, or eyestrain from screens with poor resolution. Ugly systems can promote another type of eyestrain. IBM and Xerox have learned through their extensive experience in selling office equipment that beauty is sometimes as important as brawn. As a result, their products are designed with aesthetics in mind.

What this all means is that you should be skeptical of vendors' claims. Just because a vendor says a product is user-friendly does not mean that it is. Remember, no vendor says his product is *not* user-friendly. You'll just have to try a product out yourself. In the final analysis, the best definition of user-friendliness is your own. If a particular product just doesn't feel comfortable, keep looking—there certainly are enough competitors out there to make it likely that one of them will give you what you need.

•*The product will be available. . . .* This is a standard marketing strategy. Some companies announce a product just to see if they get enough interest. In some cases a working prototype has been developed—but not always. (This was apparently the case at a recent show where some of the announced Japanese models were, according to one market analyst, merely empty boxes.) If the manufacturer or publisher finds dealer or consumer interest, then production will begin. Some say this is a necessary caution because of the costs involved in hardware or software development.

It also happens that when one company announces a new product, the competition announces "me too" products that will be available around the same time. Some companies feel that this practice is unavoidable because of the intense competition for dealers' shelf space. If one vendor has a product that everyone wants, the others had better add a similar one to their product lines.

In both these instances, however, the development time—per Murphy's Law—is always longer than expected. All this means that if you see a product promised within a certain period of time, it's probably safe to multiply that time by a factor of two or three.

•*That feature will be available in the update.* This industry is populated by intelligent people—both users and vendors. As a result, consumers keep asking for more and more features and vendors keep designing them.

In terms of what this means for you, think of that old "promise her anything" perfume commercial. In many cases, the most important sale for any salesperson is the next one, not the last one. In other words, if you buy a product on the assumption that the feature you need will be available soon, expect to receive a lot of Arpège. As to when you'll get the update or enhancement, see *"The product will be available. . ."* above.

•*It's IBM compatible.* The story you are about to read may be apocryphal, but a reputable dealer swears it's true. At a recent Comdex convention, scores of companies claimed various levels of IBM compatibility. One particular machine amazed and impressed spectators as it seemed to meet every test of IBM compatibility. However, one of the more curious and intrepid spectators followed the wires attached to this new IBM-compatible machine to the back of the booth, to an IBM PC!

Different outfits have defined different guidelines for IBM compatibility. Future Computing, a leading market-research firm, has defined four levels of PC compatability. The highest level is the "copycat," which has identical hardware and software but is illegal because certain portions of IBM's read-only memory (ROM) are copyrighted. The next level down is "IBM PC compatible," which means identical hardware and software except for that copyrighted ROM code. If the floppy disks, the keyboard, and the graphics are similar, this IBM clone could run most programs written for the IBM PC. According to Future Computing, only the Compaq and Columbia Data computers meet this test.

The next level is "data compatible," which means that a data disk (not the system disk) can be moved from the IBM PC running, say, Visicalc to a data-compatible machine running Visicalc. This is possible if the other computer uses the same disk and the same operating system (for example, MS-DOS or CP/M-86). This does *not* mean that you can use the Visicalc system disk you pulled out of the PC. If you could, then that computer would meet the criteria for one of Future Computing's higher levels. A handful of microcomputers, including Wang, Eagle, and Dynalogic, meet this test.

The fourth and lowest level of compatibility is "conversion compatible," which means that the floppy-disk format is different (for instance, the microfloppies on the CDI Dot). In this case, the software publisher must come out with a version for the conversion-compatible machine, and then the user must continually convert data disks from one format to the other.

The most important point here is that—to paraphrase Shakespeare—an IBM Personal Computer by any other name might not smell as sweet. In other words, it's easy to advertise compatibility, but your

CONTINUED ON PAGE 182

Your DATABASE Specialists

1

dBASE II $398

The most widely sold DBMS for micros, dBASE II defines the state of the art. An inexperienced user can create a dBASE file, begin data entry, and print out a report in minutes; the experienced programmer can create complex program systems using dBASE'S unique programming language. Both can use automatic program generators and other programming tools to create applications quickly and easily.

QUICKCODE: Automatically creates menus and "intelligent" data entry screens which check input for correctness. Eliminates 80–100% of dBASE programming time! **$185.00**

dUTIL: Formats programs to make them easier to read, detects some errors and combines program files to make them run fast! **$59.00**

dGRAPH: Allows you to see your dBASE file in graphic form—a real aid to understanding. **$195.00**

ABSTAT: Allows you to analyze your data using a wide variety of statistical tests. Can be used with dBASE files or by itself. Also does bar graphs and plots. **$359.00**

summer specials

Condor 3 $398

dBASE II's leading rival, Condor 3 is a relational DBMS with powerful query and report generation capabilities similar to those on main frames.

Condor 1: Lacks the query and report generation facilities of Condor 3. Excellent for simpler applications. **$189.00**

1-to-3 upgrade: When you need more power, this low cost kit will get you there. **$225.00**

Orders must be PAID by JULY 31 to qualify for these special prices

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PROGRAMMING INTERNATIONAL

PC SOFTWARE – MS DOS

	LIST	SALE
Advanced Operating Systems		
The Programmer ...	200	150
Alpha Software		
Apple-IBM Connection	195	135
Database Manager .	245	169
Mail List	95	67
Typefaces	125	87
American Training International		
Power for PC DOS .	75	56
Applied Software Technology		
QBASE	189	143
Versaform	389	259
Aptek		
Epson to Prism		38
PC Ticker Tape		22
Rainbow Writer		125
Ashton-Tate		
dBASE II .....[5]	700	398
dBASE II w/User's Guide .....[5]	729	449
Financial Planner ..	700	489
Aspen Software		
Grammatik	75	56
Proofreader 32K ...	50	38
Proofreader 50K ...	50	38
Proofreader 80K ...	50	38
Beaman Porter		
Powertext	399	369
Best Products		
Personal Financial pgm	95	66
Bible Research		
THE WORD Processor		146
Byrom Software		
BSTAM	200	149
BSTMS	200	149
Cavalier		
Championship Blackjack	40	30
Central Point Software		
COPY II PC	40	35
Comprehensive Software Support		
PC Tutor	80	60
Comshare		
Financial Modeling	325	264
Conceptual Instruments		
Desk Organizer		245
Condor		
Condor 1	295	189
Condor 3	650	398
Continental Software		
FCM (First Class Mail)	125	79
Home Accountant Plus	150	99
Property Management	495	359
Datamost		
Real Estate Inves. Prg.	130	95
Denver Software		
Easy	750	562
Eagle		
Money Decisions Vol 1	199	129
Money Decisions Vol 2	230	169
Money Pack Vol 1 & 2	400	299
Emerging Technology		
Edix	195	149
WORDIX	195	149
EDIX + WORDIX ..	390	279
Fox & Geller		
dGRAPH	295	195
dUTIL	99	59
Quickcode	295	185
Friendly Software		
Friendlyware	50	38
Hayes		
Smartcom 2	119	90
Howard Sams		
Programmer	200	150
Howard Software		
Real Estate Analyzer	250	185
Tax Preparer 1983 .	250	185
Information Solutions, Inc.		
25:01 The 25th Hour	100	74
IUS		
Easy Filer	400	279
Easy Planner	250	188
Easy Speller 2	225	135
Easy Speller 2/ Legal	350	229
Easy Speller 2/ Medical	350	229
Easy Writer II	350	229
Financial Mgmt (AR/AP/GL)	1495	1019
AP	595	389
AR	595	389
GL	595	389
Inventory	595	389
Order Entry	595	389
Payroll	595	389
Innovative Software		
Fast Graphs	295	159
TIM III	495	279
Insoft		
Data Design	225	169
Intellect Associates		
PC Text	100	73
Window	150	113
ISM		
Graphmagic	90	65
Graphmagic Combo	150	119
Mathemagic	90	65
Lexisoft		
Spellbinder	495	259
Lifeboat		
C-Food Smorgasbord	150	125
Lattice C Compiler .	500	415
Lifetree		
Volkswriter	195	129
Lightning		
Master Type	50	38
Link Systems		
Data Fax	299	224
Lotus		
1-2-3	495	369
Mark of The Unicorn		
Final Word	300	223
Mince	175	139
Metasoft		
Benchmark Mail List	250	184
Benchmark Word processor	500	367
Micro Lab		
Tax Manager	250	188
Micro Pro		
Infostar .....[4]	495	327
Mailmerge	250	165
Reportstar	350	231
Spellstar	250	165
Word/Mail .....[4]	695	426
Word/Spell .....[4]	695	426
Word/Spell/ Mail .....[4]	845	558
Wordstar .....[4]	495	327
Microcraft		
Legal Billing/ Timekeeping	750	385
Professional Billing/Time	750	385
Microsoft		
Flight Simulator	50	38
μLisp/μStart	250	188
Multiplan	275	189
μMath/μSimp	300	225
Microstuf		
Crosstalk/ Smartmodem	195	135
North American		
<<ANSWER>> ...	250	159
Northwest Analytical		
Statpak	495	369
Oasis		
Punctuation & Style		109
The Word Plus	150	112
PBL Corporation		
Personal Investor ..	145	98
PC Software		
Creatabase	75	67
Peachtree		
Series 4 Pak (GL/ AR/AP)	595	349
Peter Norton		
Utilities	80	60
Ryan-McFarland		
RM/Cobol Full Dev System	950	713
RM/Cobol Runtime Only	250	188
Scripps Data		
Job Cost system ...	495	371
Select Information Systems		
Select Wordprocessor	595	356
Softward		
Wordmak	500	340
Software Arts		
TK!Solver		224
Software Products International		
Logicalc	190	142
Logiquest II	250	188
Logiquest III	550	412
Procalc	350	262
Software Publishers		
PFS: File	140	105
PFS: Report	125	94
Software Technology		
The Creator	300	224
Sorcim		
Supercalc	195	129
Supercalc 2	295	185
Superspellguard ...	195	129
Superwriter	295	179
Southeastern		
Data Capture	120	90
Supersoft		
Optimizer	200	149
Personal Data Base	125	93
Synapse Video		
File Manager	150	112
Synergistic		
Data Reporter	250	169
Texasoft		
Thinker	75	56
Versatext	200	172
Versa Computing		
Graphics Hardcopy	25	19
Versawriter		
Graphics Tablet	299	249
Visicorp		
Business Forecasting Model .	100	78
Desktop Plan	300	229
Visicalc	250	169
Visidex	250	189
Visifile	300	219
Visischedule	300	234
Visispell	225	183
Visitrend/plot	300	215
Visiword	375	298
Woolf		
Move It	150	99

PC SOFTWARE—CP/M 86

	LIST	SALE
Ashton-Tate		
dBASE II	700	398
Byrom Software		
BSTAM	200	149
BSTMS	200	149
Comshare		
Financial Modeling	325	264
Dictronics		
Random House Thesaurus	150	113
Digital Research		
CBASIC 86	200	150
CIS COBOL 86	800	600
Concurrent CP/M-86	350	264
CP/M-86	60	45
Level 2 COBOL 86 ..	1600	1200
Pascal MT+86	400	300
Pascal MT+86 with SPP-86	600	450
SID 86	150	94
Metasoft		
Benchmark Mail List	250	184
Benchmark Word Processor	500	367
Micro Focus		
CIS COBOL 8086 ...	850	637
Organic Software		
Datebook	395	331
Milestone	395	269
Ryan-McFarland Corp		
RM/COBOL Full Dev System	950	713
RM/COBOL Runtime Only	250	188
Structured Systems		
Analyst	250	188
AP	1250	790
AR	1250	790
GL	1250	790
Inventory	1250	790
Letterright	200	150
NAD	100	75
Order Entry	1250	790
PR	1250	790
Q Sort	100	75
Woolf		
Move It	150	99

PC GAMES

	LIST	SALE
Acorn Software		
Lost Colony	30	22
Automated Simulations/EPYX		
Curse of Ra	20	15
Temple of Apshai ...	40	30
Upper Reaches of Apshai	20	15
Avalon Hill		
Andromeda Conquest	23	17
Computer Stocks & Bonds	25	19
Draw Poker	21	16
Galaxy	25	19
Midway Campaign .	21	16
Voyager	25	19
Blue Chip		
Millionaire	100	75
Broderbund Software		
Apple Panic	30	22
Datamost		
Pig Pen	30	22
Space Strike	30	22
Infocom		
Deadline	50	37
Starcross	40	30
Suspended	50	38
Zork I	40	30
Zork II	40	30
Zork III	40	30
Omric		
Blingsplats	35	26
Championship Draughts	35	26
Space Guardian	30	22
Sierra On Line		
Crossfire	30	22
Frogger	35	26
Ulysses & Golden Fleece	40	29
Sirius		
Conquest (Call to Arms)	30	22
Strategic Simulations		
Warp Factor	40	30

PC HARDWARE

	LIST	SALE
PI		
PC-Hayes Cable	35	29
AST Research		
Combo + 64K	595	429
Mega + 64K	595	429
Corvus		
PC Interface, Cable, Man.	300	239
Kraft		
Joystick	70	52
Microsoft		
64K RAM	350	249
64K RAM Chip Set .	175	139
128K RAM	525	379
192K RAM card	700	499
256K RAM card	875	624
QCS		
Big Blue	595	449
Quadram		
64K Quadboard	395	289
256K Quadboard ...	595	435
Symtec		
Light Pen	150	126
Tandon		
TM100-2 Drive (5¼"DS) .....[5]	650	249
TG		
Joystick	65	49
Trackball	65	49

Sample Special

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3

Summer Specials

APPLE II/II+ DOS

Product	LIST	SALE
Applied Software Technology		
Versaform	389	269
Versaform-Pascal	245	180
Versaform/Corvus Hrd Disk	495	360
ARTSCI		
Magic Mailer	70	49
Magic Pack Combo	225	156
Magic Window	100	75
Magic Window II	150	109
Magic Words	70	49
Avant Garde		
Ultra Plot/DIF/ Datagraph	99	71
Beagle Brothers		
Apple Mechanic	30	22
Beagle Bag	30	23
DOS Boss	24	17
Flex Text	30	23
Pronto DOS	30	23
Utility City	30	22
Broderbund Software		
Bank Street Writer	70	53
General Ledger w/AP	495	305
Payroll	395	275
Computer Station		
Combined Enhanced Graphics	55	40
Station Master	175	136
Comshare		
Image Maker	175	126
Continental Software		
CPA #1,2,3,4 (all 4) [5]	1000	609
CPA #1-GL	250	159
CPA #2-AR	250	159
CPA #3-AP	250	159
CPA #4-Payroll	250	159
CPA #5-Property Management	495	352
FCM (First Class Mail)	100	75
Home Accountant	75	52
Crane		
Menu Generator	40	29
Creative Curriculum		
Speed Reading Courseware	99	75
Dakin 5		
Business Bookkeeping System	395	299
Budget Planner	150	112
Depreciation Planner	395	299
Datamost		
Reap (Real Estate)	130	90
Tax Beater	130	90
Write On	130	99
Datasoft		
BASIC Compiler	100	75
Lisp Interpreter	125	94
Micropainter	35	25
Decision Software		
Accountant	129	97
Accountant with DBCalc	149	112
DBCalc		20
Delta Software		
Bookkeeper Check Writer	40	29
Bookkeeper Master	90	68
Denver		
Financial Partner	250	188
Pascal Programmer	296	223
Pascal Tutor	125	97
Eduware		
Algebra 1	40	30
Algebra 2	40	30
Algebra 3	40	30
Compu-Math/ Arithmetic Skl	50	37
Compu-Read	30	22
Compu-Spell/ Data Disk 4-8 (ea)	20	15
Compu-Spell/ System	30	22
Counting Bee	30	22
Decimals	49	37
Fractions	49	37
Metri-Vert	16	12
Perception	25	19
PSAT Word Attack	49	37
Rendezvous	40	30
SAT Word Attack	49	37
Spell Bee w/ Reading Primer	40	30
Statistics	30	22
Hayden		
Piewriter/Multi 80 Column	150	108
Piewriter/Standard	150	108
Hayes		
Micromodem II w/Term Pgm	409	289
Terminal Program	100	75
Highlands		
CRAE	40	30
EZ Ledger	60	37
MCAT	25	19
Howard		
Creative Financing 1983	195	149
Real Estate Analyzer	195	146
Tax Preparer 1983	225	179
IUS		
Datadex	150	108
Datadex/Hard Disk	300	216
Easy Mover	100	75
Forth Development System	140	101
Tellstar Level 1	40	30
Tellstar Level 2	80	58
Insoft		
ALD System II	75	56
Electric Duet	30	23
Graforth II	75	56
Transforth II	125	94
ISM		
Graphmagic	90	65
Mathemagic	90	65
Kensington		
Format II	150	113
Lightning		
Master Type	40	30
Link Systems		
Data Fax	199	149
Data Link	100	75
Link Disk	70	51
Link Index	195	149
Link Sampler I	60	45
Link Video	55	42
LJK Enterprises		
Data Perfect	100	78
Edit 6502	100	78
Lettr Pefct w/ Mail Merge	150	112
Lotus		
Executive Briefing System	199	149
Micro Lab		
Asset Manager	200	144
Data Factory	300	216
English SAT #1	30	22
Invoice Factory	200	144
Learning System	150	108
Merger	50	37
Painter Power	40	30
Payroll Manager	300	216
Tax Manager	180	129
US Constitution Tutor	30	22
Visiblend	50	37
Visifactory	75	54
Wall Streeter	300	216
Microsoft		
Applesoft Compiler (TASC)	175	119
Multiplan	275	198
µMath/µSimp (ADIOS)	250	194
Time Manager	150	116
Typing Tutor II	25	19
Muse		
Address Book	50	36
Dataplot	60	43
Elementary math	40	29
Form Letter Module	100	75
Supertext Home Office	125	94
Supertext Professional	99	74
The Voice	40	29
Omega		
Inspector	60	49
Locksmith	100	75
Optimized System Software, Inc.		
Speed Read Plus	60	43
PBL		
Personal Investor	145	99
Penguin		
Additional Fonts Char Set	20	15
Comp Graphics/ Apple Tablet	120	86
Complete Graphics System	70	50
Graphics Magician	60	45
Special Effects	40	30
Special Effects Apple Tablet	70	50
Phoenix		
Zoom Graphics	50	38
Program Design		
New Step-By-Step	80	58
Quality Software		
Bag of Tricks	40	30
GBS—DB Appl Dev Program	650	488
Sensible		
Applesoft + Struc. BASIC	40	30
Best	40	30
Bug, The	50	32
Build Using	30	23
Disk Organizer	30	23
Disk Recovery	30	23
DOS Plus	25	19
Edit Soft	40	30
Image Printer Epson	40	30
Image Printer Letter Qual	40	30
Image Prtr NEC/ Dot Matrix	40	30
Multi Disk Catalog	25	19
Quadrant 6112	30	23
Quickloader	25	19
Sensible Speller	125	94
Sensible Speller Pascal	125	94
Sens. Speller Word Handler	125	94
Super Disk Copy	35	26
Sierra On Line		
Dictionary	100	70
EPF IV	80	56
General Manager II	230	168
Screenwriter II	130	85
Screenwriter Professional	200	149
Silicon Valley		
Dictionary	125	94
List Handler	90	68
Word Handler	199	145
Sirius		
Pascal Graphics Editor	100	75
SOF/SYS		
Executive Secretary	250	188
Executive Speller	75	56
Softech		
BASIC Compiler & Runtime [5]	225	169
Softeach	125	94
UCSD p-System Set	625	469
Xenofile	50	39
Software Dimensions		
Accounting + II AP	395	289
• AR	395	289
• GL	395	289
• Inventory	395	289
• Payroll	395	289
• POE	395	289
• POS	395	289
• SOE	395	289
Software Publishers		
PFS: File	125	94
PFS: Graph	125	94
PFS: Report	125	94
Southeastern		
Data Capture	65	49
Data Capture/ Smarterm	90	65
Data Capture/Videx	90	65
Data Capture/ Super Serial	90	65
Data Capture/ Superterm	90	65
Southwestern		
ASCII Express Professionl	130	89
Merlin	65	49
Printographer	50	38
Stoneware		
Compucube	30	23
DBMaster	229	148
DBMaster/Hard Disk	499	359
Electronic Price Sheet	100	75
Graphics Proc Sys (Prof)	179	129
Graphics Proc. Sys (Std)	69	52
Micro Memo		
Statpak	99	71
Utility Pak 1	99	65
Utility Pak 2	99	65
Synergistic		
Data Reporter	220	158
Data Reporter/ Hard Disk	220	158
Global Pgm Line Editor	65	49
Higher Graphics II	3	26
Higher Text II	40	30
Integer BASIC Compiler	150	108
Mailing List Database	50	38
Modifiable Database	80	59
Program Line Editor	40	30
Stargazer's Guide	30	23
Versa Computing		
AXE-Apple Extended Editor	70	53
Versawriter Exp. Pak 1	40	30
Versawriter Exp. Pak 2	40	30
Videx		
80 Col Preboot Applewriter	19	15
80 Col Preboot Visicalc	49	37
Videoterm Utilities Disk	37	28
Visicalc Mem Ex w/Preboot	89	67
Visicorp		
Business Forecasting Model	100	78
Desktop Plan	250	194
Visicalc	250	169
Visidex	250	194
Visifile	250	169
Visilink	250	194
Visiplot	200	156
Visischedule	300	234
Visiterm	100	79
Visitrend/Plot	300	234
Winner's Circle		
Disk Encryption	60	45

APPLE IIe SOFTWARE

Most Apple II products also run on the IIe (call for details). Products below are specially designed for the IIe.

Software Dimensions	LIST	SALE
Accounting + IIe AP	395	289
• AR	395	289
• GL	395	289
• Inventor	395	289
• Payroll	395	289
• POE	395	289
• POS	395	289
• SOE	395	289
Software Publishers		
PFS: File	125	94
PFS: Graph	125	94
PFS: Report	125	94
Visicorp		
Visicalc	250	189

APPLE /// SOFTWARE

Product	LIST	SALE
Applied Software Technology		
Versaform	495	371
Datamost		
Write On	130	99
Denver Software		
EASY	750	562
Insoft		
ALD System III	75	56
Transforth III	125	94
Link Systems		
Data Fax	249	187
Link Index	195	149
Link Sampler I	60	45
Link Video	55	42
Software Publishers		
PFS: File	175	129
PFS: Graph	175	129
PFS: Report	125	94
Visicorp		
Business Forecasting Model	100	78
Desktop Plan	300	234
Visicalc Advanced	400	312
Visischedule	300	234

APPLE HARDWARE

Product	LIST	SALE
Eastside		
Wildcard	130	109
Hayes		
Micromodem II [5]	379	259
Kensington		
System Saver Fan	90	69
Kraft		
Joystick	65	49
LJK		
Lower Case Char Gen	25	19
Micro-SCI		
A2 35T Disk Drive	479	329
Microsoft		
16K Ram Card	100	69
Premium System [5]	695	489
Softcard	345	219
Personal Computer		
Applicard 6 MHz	595	449
TG Products		
Joystick	60	45
Selectaport	60	45
Trackball	65	49
Versa Computing		
Versawriter Graphics Tablet	299	249
Videx		
Enhancer II	149	119
Function Strip	79	65
Inverse Character Set	29	24
Lower Case Chip	29	24
Lower Case Chip (Rev 0-6)	35	29
Micromodem Firmware	29	24
Soft Video Switch	35	29
Videoterm Switchplate	19	16
Videoterm with Softswitch	375	239

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Your CP/M & Hardware Source 4

CP/M-80

	LIST	SALE
Adventure International		
Adventures 1-12 (Req Z80)	129	97
ATI		
Power for CP/M	75	54
Anderson-Bell		
ABSTAT		359
Artificial Intelligence		
Dental (PAS-3)	995	749
Medical (PAS-3)	995	749
Ashton-Tate		
Bottom Line Strategist	400	279
dBASE II	700	398
dBASE II w/User's Guide	729	419
Aspen Software		
Grammatik	75	56
Proofreader	50	38
Balcones		
BOSS Fin. Acctg System	2495	1496
Byrom Software		
BSTAM	200	149
BSTMS	200	149
Caxton		
Cardbox	245	177
Comm soft		
Roots/M	195	142
Computer Control		
FABS-BTree File Access	195	146
Ultrasort II	195	146
Computer development		
Image	495	356
Comshare		
Planner Calc	99	74
Target Application Guide	50	38
Combo Pak	125	94
Condor		
Condor 1	295	189
Condor 3	650	398
Designer Software		
Palantir	425	319
Dictronics		
Random House Thesaurus	150	113
Digital Research		
Access Manager	300	225
CB80	500	395
CBasic	150	94
CIS Cobol	800	595
Despool	50	38
Display Manager	400	295
MAC	90	75
Pascal MT+	350	262
Pascal MT+ with SPP	500	395
PL/1 80	500	375
SID	75	63
SPP	200	150
ZSID	100	88
DJR Associates, Inc.		
FMS 80	995	625
FMS 80-1	495	312
FMS 80-2	495	312
Ecosoft		
Microstat	295	248
Microstat 3.0	395	320
Epic		
Supervyz	150	94
Faircom		
Micro B+ (CBasic)	260	211
Micro B+ (Other)	260	211
Fox & Geller		
dGRAPH	295	195
dUTIL	99	59
Quickcode	295	195
Quickscreen/ CBasic	149	125
Quickscreen/ dBASE II	149	125
Quickscreen/ FMS-80	149	125
Quickscreen/ MBasic	149	125
FYI, Inc.		
Superfile	195	129
Human Soft		
dBPlus	125	95
Infocom		
Deadline	60	43
Starcross	50	38
Suspended	50	38
Zork I	50	38
Zork II	50	38
Zork III	50	38
ISM		
Mathemagic	100	72
Ithaca Intersystems		
Pascal BZ	450	375
Pascal Z	450	375
Pascal Z & BZ	650	542
Lexisoft		
Spellbinder	495	281
Mark of The Unicorn		
Final Word	300	223
Mince	175	139
Metasoft		
Benchmark Mail List	250	184
Benchmark Wordprocessor	500	367
Micro Pro		
Calcstar	145	96
Datastar	295	195
Infostar	495	327
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Spellstar	250	165
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Word/Spell	695	426
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Wordmaster	150	99
Wordstar	495	327
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BASIC 80	350	252
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COBOL 80	750	562
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Multiplan	275	198
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Crosstalk/ Smartmodem	195	135
Northwest Analytical		
Statpak	495	369
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ACT 68	175	126
ACT 69	175	126
ACT 80	175	126
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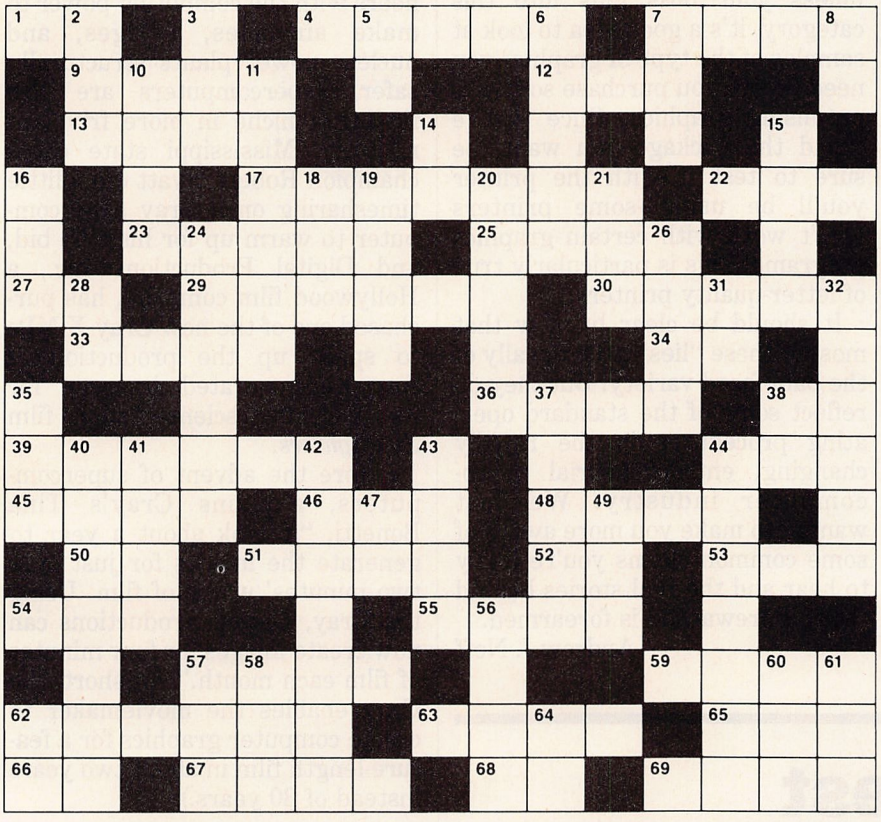
A Hacker's Crossword Puzzle



ACROSS

1 Either/_____
4 FIFO linear list
7 General-purpose interface bus _____-488
9 Friendliness target
12 Light _____ (CRT tracer)
13 Number of unconditional guarantees for software
17 TV alternate
22 End where node is popped
23 Debugging command (BASIC)
25 So be it
27 CONTINUE's partner (FORTRAN)
29 Multidimensional data structures
30 Telephone link
33 Possession of soldiers, sailors, and items in an ordered list
34 27 across
36 A number of
38 _____line
39 Action to be performed (in instruction cycle)
44 Nonutilitarian graphics
45 Programmable Read-Only Memory
46 Exclusive OR statement
48 Terminal (abbr.)
50 Instruction Register
51 Offered by waiters and friendly software
52 Alternating Current
53 Greater than zero (abbr.)
54 Bit value
55 Set of 13 across
57 Bits per second
59 Apple of Apple's eye
62 Text-editor document
63 Trig function
65 NEXT's predecessor (BASIC)
66 50 across
67 Look into memory (BASIC)
68 FOR-NEXT loop preposition (BASIC)
69 Events controlled by a common clock pulse are in _____

DOWN

2 Execute program (BASIC)
3 Returns the number of characters (BASIC)
5 _____ and running
6 Erasable Programmable Read-Only Memory
7 Truncates everything to right of decimal (BASIC)
8 Electronic Arrays
10 Arrange
11 Explanatory program statement
14 3.14159 . . .
15 Upper left corner of monitor
16 Returns a specified number of characters starting at a specified location (BASIC, omit "$")
18 Optical Character Recognition
19 Close
20 Chores
21 Statement for 11 down (BASIC)
24 Unpredictable
26 Graph point
28 1 across
31 Execute
32 Six-legged debugger
35 Remove node from stack
37 Representation for 0 through 7
38 1 across
40 Ben Franklin, Diablo, or Daisywriter
41 Oldest nonvolatile memory
42 Command to "do it"
43 BLOADs and starts machine-language program
44 Make louder
47 38 across
49 Emitter-Coupled Logic
56 One
57 Bit-Oriented Protocol
58 Is's plural
60 Father's adjacent node
61 Joins two graph nodes
62 Right input
64 Negative

Answers to the crossword puzzle are on page 187. —Glenn C. Ferrell

CONTINUED FROM PAGE 176
understanding of the term might differ from the vendor's concept.

•*It prints* xxx *characters per second.* Looking at character-per-second ratings on printers is like looking at mileage ratings on cars—if the automobile manufacturers were responsible for testing their own cars. But because the EPA doesn't rate printers, you can't "use these numbers for comparison" except with printers from the same manufacturer.

The problem here is apparently not with the numbers themselves but with what the numbers refer to. According to one dealer, the character-per-second rating could reflect either the average speed of the print head or its "burst" speed. Essentially, it's the difference between a race car's average speed around the track and its speed on the straightaway. The best way to get an accurate indication of printer performance is to test some standard file (like a memo or report) on several printers and compare them for speed. In other words, take it out for a test drive.

•*The software has graphics.* Some people like abstract art. However, unless your boss falls into this category, it's a good idea to look at samples of the type of graphics you need before you purchase software promising graphics. Once you've found the package you want, be sure to test it with the printer you'll be using—some printers won't work with certain graphics programs. This is particularly true of letter-quality printers.

It should be clear by now that most of these "lies" aren't really of the bald-faced variety. But they do reflect some of the standard operating procedures in the rapidly changing, entrepreneurial microcomputer industry. We just wanted to make you more aware of some common claims you're likely to hear and the real stories behind them. Forewarned is forearmed.

—Andrew J. Neff

The 65 Fastest Processors on Earth

One of my favorite scenes from the 1982 movie *Thief* is the part where James Caan has to outwit an enormously powerful computer. "Wow, what a super computer," gushed a teenager several rows behind me. I doubt that a single person in the theater realized that there really *is* a category of machines called "supercomputers." While their prices may never drop to levels that average consumers can afford, supercomputers are now being used by organizations such as NASA, Boeing, and Arco to handle the sort of number crunching that conventional mainframes just can't perform fast enough.

By definition, a supercomputer must perform at least 20 million computations per second, but the newest supercomputers can actually reach peak speeds of about 400 million operations per second. (As a frame of reference, an Apple IIe cannot manage more than 1 million operations per second.) Cray Research and Control Data Corporation, both headquartered in the Minneapolis/St. Paul area, are the only two firms in the world that manufacture these mind-boggling machines. Sixty-five supercomputers are in operation today (two in Control Data's offices alone), with the cost of a single machine ranging from $4 to $15 million. For that colossal investment you get a lot of memory: solid-state storage of 256 megabytes will soon be available on Cray's new line of X-MP supercomputers, which are roughly five times faster than the original Cray-1, the world's first supercomputer.

In addition to providing engineers with the computing power to make airplanes, bridges, and nuclear power plants structurally safer, supercomputers are also finding a niche in more frivolous markets. Mississippi state chess champion Robert Hyatt did a little timesharing on a Cray supercomputer to warm up for his title bid, and Digital Productions Inc., a Hollywood film company, has purchased one of the new Cray X-MPs to speed up the production of computer-generated imagery for its upcoming science-fiction film *Starfighters.*

Before the advent of supercomputers, explains Cray's Tina Bonetti, "it took about a year to generate the images for just over two minutes' worth of film. Using the Cray, Digital Productions can now create images for four minutes of film each month." (In short, the Cray enables the moviemaker to create computer graphics for a feature-length film in about two years instead of 30 years.)

Superspecialized Market

The market for supercomputers is admittedly small—so small and so specialized, in fact, that Cray Research and Control Data have strikingly similar lists of potential customers. In the worldwide supercomputer derby thus far, Cray has built, sold, and installed 50 machines while Control Data has put 15 online. When Cray engineers first went to work on the Cray-1, the company anticipated a market potential of about 80 users. Now, says Bonetti, over 400 organizations are shopping for supercomputers. Given that the purchase of just one supercomputer costs more than most Hollywood movies, it's understandable that the groups seriously scouting the market are primarily big-ticket outfits such as oil companies, airlines, NASA, and the Pentagon.

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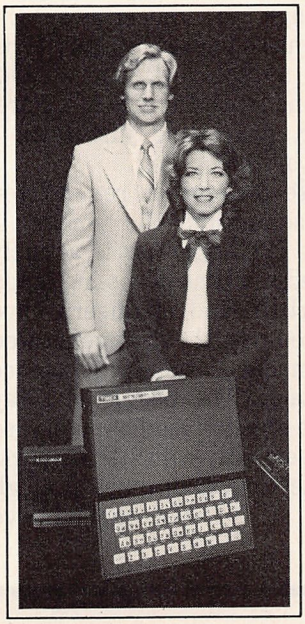

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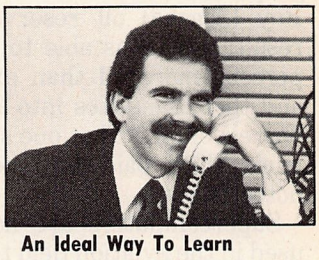

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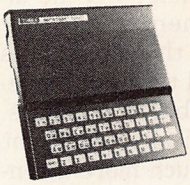

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Atlantic Richfield (Arco) is one of Cray's most satisfied clients. Arco researchers used the supercomputer to create three-dimensional graphic simulations of its Prudhoe Bay (Alaska) oil reserves. As a result, Arco was able to extract 7 percent more oil than expected—and that translates into 20 million barrels of oil. "That one simulation more than paid for the Cray," notes Bonetti.

Supercomputers are now being used in the aviation field to conduct stress analyses of jet planes, but the real race (one the Japanese are rumored to be involved in) is to build a computer fast enough to simulate airflow around an entire aircraft. Aerodynamic design is now done piecemeal by testing airflow around individual parts of a plane before combining the results. According to the National Science Foundation, the first country that designs a supercomputer capable of simulating airflow around an entire aircraft "will undoubtedly produce planes with superior performance."

Boeing Corporation used a Cray-1 to redesign the fueling system on its 747 jets. The aviation giant estimates that its supercomputer-assisted redesign will save customers about $75,000 annually in fuel costs.

The National Weather Service has purchased several Crays to aid in long-range weather forecasts. This will reduce the costs and danger of ocean shipping, says Bonetti, because ships will be able to dodge storms more easily.

The staff at Columbia University's Nevis Laboratory can't afford to buy its own supercomputer, so they've embarked on a project to build one instead. Dr. Bruce Knapp and his colleagues hope their machine will perform an astounding 100 billion operations per second when it's finally hooked up at the Fermi National Accelerator Laboratory in Batavia, Illinois.

There is hope for potential supercomputer users who lack Arco's budget and the Knapp team's ingenuity. Last year Control Data opened its Cybernet Super Center in Arden Hills, Minnesota. Clients in the U.S. and Canada can now use phone lines to tie into the Control Data supercomputer on a time-sharing basis, says Earl M. Ohlgren, the Super Center's marketing manager. The Center is also accessible via satellite to customers in Europe and Japan, adds Ohlgren.

And speaking of Japan, it's the only nation poised to challenge Cray and Control Data in the near future. The first Japanese supercomputer should be ready by the end of this year. Cray Research's plans include replacing some of its Cray-1 models with the newer Cray-2s, which the company says will be at least six times faster than any other computer on the market.

But speed isn't indicative of size. The 5-ton Cray-1 supercomputer is built in a semicircle 6 feet tall and 9 feet wide. Resembling England's Stonehenge in appearance, the machine uses enough electricity to light up a city block. The Cray-2 will be one tenth the size of its predecessor, measuring just over 1 foot tall by 3 feet long.

If those dimensions remind you of an aquarium, the image is apropos. The computer is actually immersed in a tank of cooling liquid fluorocarbon, and engineers have discovered that the heat generated by the machine causes turbulence in the tank. The people at Cray think the effect is kind of pretty, so they're seriously considering packaging the Cray-2 in a see-through case. —George Manlove

Chip Designs: What's Here, What's Coming

Most people seem to buy personal computers in much the same way they buy automobiles. For the average car buyer, price is the most important aspect. Second on the list of concerns are such factors as seating capacity and gas mileage. Third is the look and feel of the auto: the color, the streamlining, and the interior accoutrements. If any thought is given to the engine, it is in the most general terms of horsepower and the number of cylinders.

The more technically proficient auto buyer pays much more attention to the details of engine performance. He or she knows that if the job the auto is to do has been defined correctly, attention to such details can mean getting much more for each dollar spent.

So, too, with the purchase of a personal computer. Paying attention to the technical aspects of the engine (in this case, the microprocessor) means that you won't be paying for more "horsepower" than you really need, leaving you more to spend on needed peripherals and software.

Those details of a personal computer's microprocessing engine that are important in comparing one system with another include how many bits are processed at a time as a single block of data (4, 8, 16, or 32), the size of the internal bus, the size of the external bus, clock speed, and the instruction set. While many other differences do exist among the various microprocessors now on the market, paying attention to the five listed here could save you anywhere from several hundred to several thousand dollars at initial purchase and even more over the long term. It could also prevent very expensive software conversions at some point

in the future if you decide to upgrade to a more sophisticated, but incompatible, machine.

Nybble, Byte, or Word

Microprocessors are best evaluated in terms of the units into which they group bits. Depending on their designs, microprocessors handle data in nybbles (4 bits each), bytes (8 bits), or words (16 or 32 bits). A byte roughly equals one text character; a word equals two. Because a 16/32-bit word can express a far bigger binary number than an 8-bit byte, microprocessors that are able to handle data in words are superior for heavy-duty number crunching. The data-unit size chosen by a microprocessor manufacturer is partly a function of the process technology being used—how many transistors and interconnecting lines can be compressed onto a single chip—and partly a function of the market for which the microprocessor is being designed.

Clock Speed

The clock speed of a microprocessor is simply the number of times it can process 1 bit of information in 1 second. This is measured in megahertz (MHz) or millions of cycles per second. Most currently available microprocessors operate in the 2- to 8-MHz range, but some of the newer ones just coming off the production lines can achieve cycle times as high as 10 to 25 MHz. Again, this is mostly a function of process technology. Usually, the denser the chip, the shorter the distance information must travel and thus the faster it is.

Sometimes, speed is a function of the market at which the processor is being aimed. Indeed, the same semiconductor production line can produce microprocessors with speeds ranging all the way from 2 MHz to 25 MHz. The prices computer manufacturers pay for these chips is a function of the number produced. The chips with the highest speeds are produced in small numbers and thus are the

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most expensive. The lower-speed chips, usually made in large numbers, are relatively cheap. Semiconductor manufacturers' processes have improved over time, though. Five to eight years ago, most manufacturers were producing the largest number of microprocessors in the 1- to 5-MHz range, but they are now producing chips in the 4- to 20-MHz range.

Internal Structure

A complicating factor in assessing the various processing "engines" available is the fact that all 8-bit microprocessors are not created equal, and the same goes for 16- and 32-bit processors.

This is most evident in the bus structures of some of the more common processors. The first microprocessors available in the early '70s were 4-bit models that sent information to the random-access memory over 4-bit internal data buses and communicated with the external world of terminals and peripherals over 4-bit external buses. As microprocessor technology evolved, though, the situation became more complex. While the earliest 8-bit chips had 8-bit internal buses and 4-bit external buses, processors handling internal and external communications 8 bits at a time soon became the standard. Today, though, we have 16- and 32-bit chips with 8-, 16-, or 32-bit external buses and 16- or 32-bit internal buses.

The issue is even more complicated in the case of a microprocessor's instruction set (the vocabulary of fundamental commands that control the microprocessor). The earliest 8-bit processors mixed 4- and 8-bit instructions; later chips were purely 8-bit; and more recent designs mix 8- and 16-bit, 8-, 16-, and 32-bit, and 16- and 32-bit instructions.

The choice of bus structure and instruction set is usually a function of the market the semiconductor manufacturer perceives itself as serving. The earliest microprocessors were used mainly in control-oriented applications. Discovered by hobbyists and computer hackers, these control-oriented chips were adapted for personal computing applications. As processing technology and the computing market began to expand, manufacturers entered the market with enhanced microprocessors featuring bus structures and instruction sets specifically designed for each of today's particular applications.

Evaluating Parameters

The respective importance of these details of microprocessor design in your choice of a personal or small-business computer depends on what you plan to do with your new machine.

For simple word processing and accounting, for example, a well-designed 8-bit system is more than adequate. But which 8-bit system? Because it was the only one available to system designers at the time, the earliest 8-bit entry in the small-computer market was Intel's 8080. But the processor of choice in a large number of personal computer systems built for the CP/M operating system is the Z80. One big advantage of the Z80 is that its manufacturer, Zilog Inc., deliberately included the 8080 instructions as a subset of its larger instruction set that was specifically designed for computing applications. Less common is the 6800 from Motorola, which has an architecture and instruction set more like those used in minicomputers. The 6502 microprocessor from MOS Technology has achieved some success in 8-bit systems from Apple, Commodore, and Atari. Although somewhat similar in architecture to the 8080 and Z80, it is simpler to program and less expensive.

The money you save by choosing an 8-bit system over a 16-bit system can be applied to purchasing peripherals that enhance the particular, narrowly defined application you've delineated. If you feel the need for improved performance, you don't have to go to a 16-bit system (even though that would at least double the performance). Improvements in performance can be achieved through the use of a number of "virtual cache" programs or by upgrading your 2- or 4-MHz microprocessor board to one with a 6- or 8-MHz processor.

If your immediate plans are rather ambitious, it might be better to consider one of the 16-bit personal computers. The big advantage of 16-bit computers is not that they are more powerful, but that they usually can access larger amounts of random-access memory (RAM)—anywhere from 1 megabyte to 1 gigabyte (1 billion bytes) as opposed to a maximum of only 64K bytes for an 8-bit machine. This can be important when you have a lot of data to work with in running an accounting program or a sophisticated database management program.

If your computing requirements are currently modest but you expect your needs to grow with time in terms of number of users and kinds of applications, it is important to consider how much compatibility exists among the various members of a semiconductor manufacturer's family of 8- and 16-bit microprocessors. It is generally agreed that Intel has done the best job of providing for compatibility between the 8- and 16-bit worlds. The ease of upgrading from the 8080 has led many users to choose one of the members of Intel's family of chips.

The 8086 and 8088, which is used by IBM in its Personal Computer, are closely related third-generation 16-bit processors. The 8088 is designed with an 8-bit external bus while the 8086 has a 16-bit external bus. In almost every other respect the processors are identical, with the same internal 16-bit bus and the same instruction set. Both are capable of accessing up to 1 megabyte of RAM. Most of the 8088/86 instructions—95 in all—are only 8 bits long, and because the set is an expanded version of the 8080's, code conversion from one to the

other is easy. This explains the swiftness with which IBM has built up a software base for its Personal Computer—software developed for 8080 and Z80 systems could be upgraded with a minimum of development time and cost.

This is less true of the microprocessor families from the other manufacturers. For example, there is little or no compatibility between the 6502/6800 and the 16-bit 68000 or between the Z80 and the 16-bit Z8000. Unlike the 8088/8086, the Z8000 is a true 16-bit chip with both its internal and external buses 16 bits wide. Rather than retaining any direct compatibility with the 8-bit Z80, the Z8001 has an entirely different internal structure.

If Intel's 8086 can be said to represent a transition between 8- and 16-bit chips, the Motorola 68000 represents a bridge from the 16-bit world to the 32-bit world. The external 16-bit bus is multiplexed from a 32-bit internal architecture, with a 32-bit internal data bus.

Two new 16-bit processors, extensions of the 8086, have just been introduced by Intel and will begin to appear in personal computers over the next few years. They are the 80186 and the 80286. The 80186 essentially incorporates onto a single chip most of the functions commonly found on an 8086-based single-board computer. With the same 1-megabyte direct access capability, the 80186 is designed to replace an 8086 and about 15 to 20 other support circuits.

Even more impressive is the 8-MHz 80286, which includes on the same chip a sophisticated multilevel memory-protection mechanism as well as virtual memory addressing and memory management capability. It operates up to six times faster than the 8086 and directly addresses 16 megabytes of memory as well as handling 1 gigabyte of memory per task with its virtual memory space. Its instruction set is a superset of the 8086's and includes additions to improve high-level-language execution.

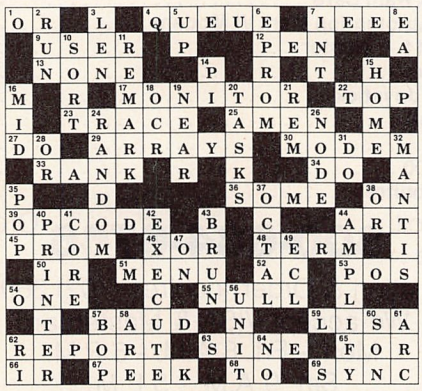
More recently, Intel announced a CP/M-on-a-chip processor extension for its 8086, 8088, and 80186 microprocessors. This CP/M-86-based operating system processor was designed to reduce development costs and improve system reliability.

Motorola has just announced the 68010 (a virtual memory version of its 68000), a floating-point coprocessor dubbed the 68881, and a single-chip version of the 68000 called the 68200. Internally, the 68010 is identical to the 68000, providing both instruction and pin compatibility. Because the changes are transparent to code that is written for the 68000, applications do not have to be rewritten to run on the 68010. Unlike the 80286, the 68010 requires external chips for memory management (the 68451) and direct memory access control (the 68450).

New from Zilog are the 10-MHz Z8003 and Z8004 virtual memory 16-bit microprocessors, designed to work in combination with the Z8015 memory-management unit. Together they provide support for multiprocessing and demand paged virtual memory support. The Z8003 and Z8004 maintain total instruction and pin compatibility with the Z8001 and Z8002, respectively. In combination with the Z8015, a total addressing capability of 32 megabytes is available with the Z8003 and 256K bytes with the Z8004.

—Bernard Cole

Answers to crossword, page 181.



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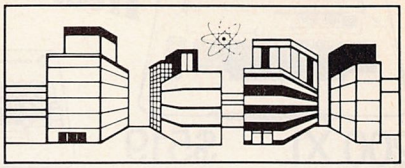

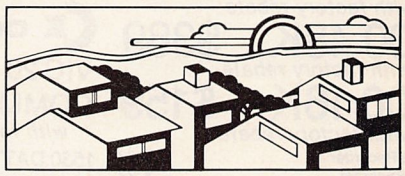

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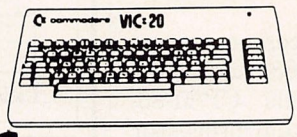

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Bank Street Writer

The word processor for kids that's powerful enough for adults

by Molly Watt

Jenny, a second-grade student, sits completely absorbed at a computer terminal in the Wheelock School library. She types slowly, using a hunt-and-peck method. She's composing with a stream of conciousness style that feels personal, almost private. Yet she is surrounded by 40 adults. I lean over her shoulder and watch as the words appear on the screen:

My father is at a meeting so he couldn't come to the open house. My mother is in my sister's classroom. We went to my classroom first. My mother talked to my teacher. My mother looked at my papers. Then she went to my sister's room to look at my sister's paper . . .

Jenny is demonstrating the use of a word-processing program, Bank Street Writer, at her school's open house, and this is only her second turn at using the program. On the preceding day her class was divided into groups of four to learn to use the program in one half-hour period. Each group worked at one of the terminals. Each student invented and typed a part of a collaborative story and helped the group proofread and edit it. All the students learned how to save their story on a floppy disk and how to print copies to share with their families and friends.

At a terminal next to Jenny's in the school library is a lively group of sixth-grade students. One is typing while the others kibitz:

"No, no, you need to indent it so the poem will print out like a poem!"

"Whoops, you spelled freedom wrong, it's an 'o' not a 'u'!"

"Don't erase now! It takes too long to back up. Wait and use replace later. It's easier."

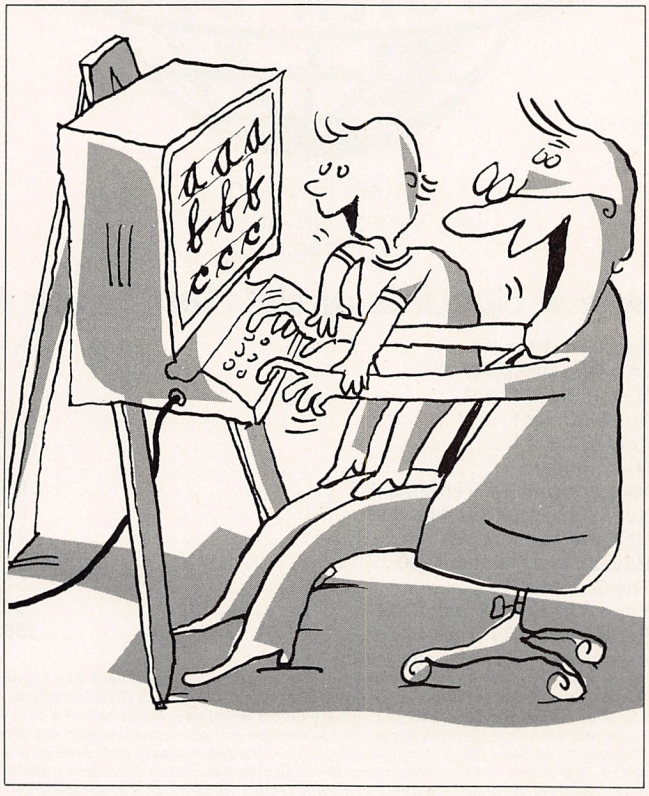

Illustration by Niculae Asciv

Cub Reporters

These students are deeply involved in the process of producing a student newspaper. They spent two class periods during the week using Bank Street Writer to write copy. Now they are using the program to create error-free, clearly formatted text before duplicating it (with a copy machine) and distributing it throughout the school. The proofing process is all important to them because they do *not* want to hear any complaints from parents or teachers about mistakes. This newspaper must be perfect. After fixing all the misspellings and typos they can find, they go on to the finer points, even checking to see that two spaces follow every period. These students are pros. And the give-and-take among them during this process of revision is both direct and meticulous.

When this sixth-grade group gets a turn to use the computer with the printer attached, they opt

for hard copy in several forms. First they choose the draft option, which prints a triple-spaced copy of their text with 38-character columns, exactly as it appears on the screen. This option lets them proof and revise quickly without having to deal with the difference between the final format and the way their text looks on the screen.

Brad and Art tear off the sheets and corner their teacher to check their work. Meanwhile, Rena, Linda, and Bob print a final draft so they can work on the newspaper's format. They decide that 30-character columns will provide them with three columns per page. When they try this width, they learn that Bank Street Writer will not print lines with less than 40 characters. They consider this information for an instant, then immediately decide that 40 characters will do quite nicely and that two columns across the page instead of three will work for the newspaper format.

When all the text is printed out in final form, the group discovers that the paper is short about five inches of copy. Linda and Rena sit down at the keyboard and compose a human-interest story called "What Would You Do with a Million Dollars??!!!" It's exactly five inches long. Now at the end of three class periods, the group has a newspaper that consists of an article entitled "Review of Bank Street Writer," a story about a school contest called "Life in These United States," a column called "Video Games Are Popular!," a poem on freedom, and the newly created filler, "What Would You Do with a Million Dollars??!!!" They are confident that they'll get their newspaper published by the end of the week.

Does this sound different from the way you learned to write? For most children in school today, the process of learning to express themselves in writing is still tedious and laborious. The stu-

Molly Watt is a freelance writer and teacher trainer living in Antrim, New Hampshire.

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dents I've just described were among the first to have access to Bank Street Writer, a new word-processing program designed especially for kids. Judging from the phenomenal success it has been having all over the country, Bank Street Writer could change the way the next generation of school children learns to write. Let's take a look at what makes this program so different from other word-processing programs for microcomputers.

Children learn to use Bank Street Writer more quickly than adults do. I watched a group of second-grade students learn it in a half hour.

Simpler Is Better

Bank Street Writer was developed specifically as a tool for student writers by Intentional Educations Inc. of Watertown, Massachusetts, and Bank Street College of Education in New York City. Bank Street College is renowned for its leadership in all aspects of education and teacher training. According to Midian Kurland, a research associate at Bank Street College, the design principles for creating a word processor for students evolved from two years of research on teaching writing to children with and without a word processor.

Researchers at Bank Street found that word processors designed for adults were not meeting student needs. Existing word processors were complex to learn, while students needed to be able to use one quickly and easily. Ideally, a student should be able to learn all about the word processor from the software itself, leaving a minimal need for documentation. For instance, students and infrequent users of a word processor have trouble moving between modes to write, save, edit, and retrieve. Thus a word processor for students should remind a user, for example, "You haven't saved your text, are you sure you want to erase that?" When it comes to formatting, most student writers don't need a lot of fancy options. Most students need only a way to set margins, center titles, and indent paragraphs. Word processors with many formatting options tend to confuse students. For these young writers, simpler is better, and Bank Street Writer is both.

Bank Street Writer provides just what the students I observed needed, namely, the ability to break the writing process into smaller, more manageable steps, letting the writer concentrate on one task at a time. Bank Street Writer uses three steps: write, edit, and transfer. Writing is the main purpose of a word processor, and the program starts up with a clear box and a blinking cursor that invites you to begin composing immediately. Your text appears on the screen in conventional upper- and lowercase characters.

By pressing the Escape key, you can move immediately to the edit mode. (A message in the upper right-hand corner of the screen reminds you which mode you are using.) Edit gives you seven clearly named choices: erase, unerase, move, moveback, find, replace, and transfer.

If you choose the transfer option, you'll see a new menu that lets you initialize a disk, save text, retrieve files, rename files, delete files from the disk, clear text from the work space, print out a draft, print out a final copy, or quit the program.

A fourth mode, the utility program, is seldom encountered by casual users, although it is well documented in the manuals provided with the software. Once you enter the utility program, you're offered a menu of options that let you change some technical aspects of the software. For example, you can change the line spacing for printed drafts or the number of the printer slot. If your Apple computer has had a shift-key modification installed to provide both upper- and lowercase letters, you can instruct Bank Street Writer to simply use the shift key rather than the more clumsy <Shift>N to produce uppercase letters. You can also change the shape of the cursor from a blinking underline to a blinking block. Finally, the utility program gives a teacher access to a list of all the file names and passwords stored on a file disk.

One utility option I found most useful allows format conversions for text files. This option lets me convert my Bank Street Writer files, which are stored in binary format, to standard Apple text-file format. Because I use both Bank Street Writer and Screenwriter II word-processing programs, this option lets me load my files into either program. (I was not able to convert files, however, between Bank Street Writer and Applewriter I.)

Bank Street Writer provides all that I usually need for my own work. The program is appropriate for those of us—including many students in both school and at home—who want a simple word processor and need help in remembering how to use it. It is not necessarily the best choice for writers with daily access to the same word processor and with more complex formatting needs. Some of my adult students, for example, found the shift between modes tedious and annoying. And some were unwilling to do without tab settings and fancier ways to include footnotes.

I watched more than 60 people learn to use Bank Street Writer. In general, it was easier for school-aged children than for adults to learn. While children learned by actually writing, adults felt a need to get an overview. Adults often read the documentation or used the

tutorial on the other side of the disk, which tended to make the entire process just a bit more frustrating for them than it was for children.

Documentation

The home version of Bank Street Writer from Broderbund Software comes with a concise, clearly written, 28-page manual. While it won't answer all your questions about word processing, it's more than enough to get started. After your first session you probably won't need the manual except when you use the utility program. One helpful feature is a combination index/glossary that defines important word-processing terms and tells you where to turn for more detailed information.

The school version of the program from Scholastic comes with more comprehensive documentation designed to make Bank Street

Students Review Bank Street Writer

I liked the word processing program very much. I like it because you can write stories and you don't have to spend a lot of time correcting them. And it can be printed on paper very easily.

Bank Street Writer is great. I was so excited about word processing I couldn't wait to get back to school Monday. From now on I'll probably hate Saturdays and Sundays. I hate getting out of school and I try to stay in every recess to do word processing on the computer. I also try to stay after school as much as I can.

I won't be able to live without Bank Street Writer. I am hoping to do word processing at the junior high next year.

by Jesse, grade 6

Some of the kids have been using a new word processor called Bank Street Writer. I personally prefer it over Applewriter because with Bank Street Writer what you see is what you get. With Applewriter what you see is not what you get. Besides, you get three different stages which are controlled by pressing Escape.

You still get to move the cursor using I, M, J, and K keys. Bank Street Writer also has a find and replace function. It is also easier to save and print. You can have it indent by using the control key and I. You can have it center by pushing the control key and C.

I used Bank Street Writer to write a poem and to write this article. I like it a lot.

by Brad, grade 5

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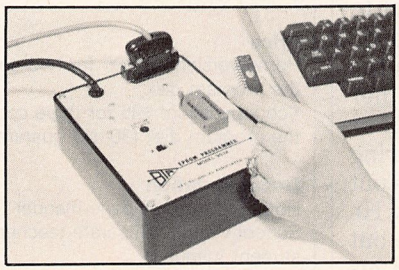

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Writer even easier to use in a classroom. A student guide presents simplified instructions for using the main features of the program. A reference guide includes the same manual as the Broderbund version with a few minor changes to eliminate computer jargon that might be unfamiliar to teachers. Other materials provided by Scholastic include a question-and-answer section to help teachers deal with specific student problems and a set of suggested classroom activities that show how word processing can be integrated into a traditional language-arts class.

All the students I observed, from second graders on up, learned to use Bank Street Writer without any documentation at all and with just a quick introduction from their teacher or one of their classmates. On the other hand, Scholastic's enhanced documentation could be helpful to teachers who are using computers for the first time and would welcome the additional support that such materials might provide.

With Bank Street Writer students find that it's fun to work at a computer and gain a sense of power and excitement as they learn to write.

Fun with Writing at Home

I've said a great deal about how Bank Street Writer works as a serious tool. But I haven't talked about how much fun it is to use.

One Saturday I took Bank Street Writer to share with my young friends Rachel, age 8, and Jotham, age 13. We sat in their kitchen and explored the tool together for the fun of finding out what it could do. Rachel sat down and started to type a joke. "How many letters are in the alphabet? Answer: 24, E.T. went home!"

We began telling jokes to each other, recounting lots of alphabet jokes and then moving on to black-and-white-and-red-all-over jokes. Rachel ran to collect jokes from her parents, while Jotham read jokes aloud from his joke book. We all laughed at the way old jokes had changed. Amidst the giggles and groans, Rachel managed to learn to use the word processor and do a lot of reading, writing, and typing. She organized information and became in a small way a student of history and sociology, all the while having fun interacting with her family. Says Rachel, "Now I don't have to copy everything over, and I don't get tired in one hand. I can just write as much as I want to."

When it was his turn, Jotham sat down at the computer without any instructions and started to type some silly sentences. Then he began to explore the options in the edit mode. Using the replace command, he exchanged small patterns of letters for different ones. "I" quickly became replaced by "etter" everywhere it appeared in his text and then was transformed again to something else. Substituting one series of letters for another, he created a whimsical gibberish in code. He laughed aloud and yelled, "Hey, Dad, look at what I'm doing!" which brought his father into the process of playing with words.

Another weekend, Rachel and Jotham used Bank Street Writer to write assigned reports for school. Each worked independently on the computer. Rachel printed her report and then set about decorating it with hand lettering and pictures. Jotham printed out his report as a draft to revise. He decided he would rather write out the finished piece by hand for his teacher.

To write this review I started with a pencil on a yellow pad and then used Bank Street Writer to shape the final draft. Rachel, Jotham, and I each used the program as a tool in our writing; each of us retained a sense of control over when to use the program and when we preferred to use our own handwriting.

Bank Street Writer is a writer's tool. It isn't the only to way to manipulate text, create revisions, or have fun with words. But I predict that it will make writing less arduous and that more students will find themselves enjoying the process: finding the right words, making numerous revisions, and creating error-free copy. □

At a Glance

Name: Bank Street Writer

Type
Simplified word processor

Manufacturers
Home version:
Broderbund Software
1938 Fourth St.
San Rafael, CA 94901
(415) 456-6424

School version:
Scholastic Inc.
730 Broadway
New York, NY 10003
(212) 505-3000

Format
Double-sided 5¼-inch floppy disk with the program on one side and a tutorial on the other

Computers
Apple II, II Plus, and IIe; Atari 400 and 800 with 48K bytes of random-access memory and one disk drive; Commodore 64 (in preparation)

Price
Home version: $69.95 for two copies of the program disk
School version: $95 for three copies of the program disk (30-day guarantee)

Documentation
Home version: 28-page manual
School version: Separate teacher and student manuals

Audience
Elementary school students to adults

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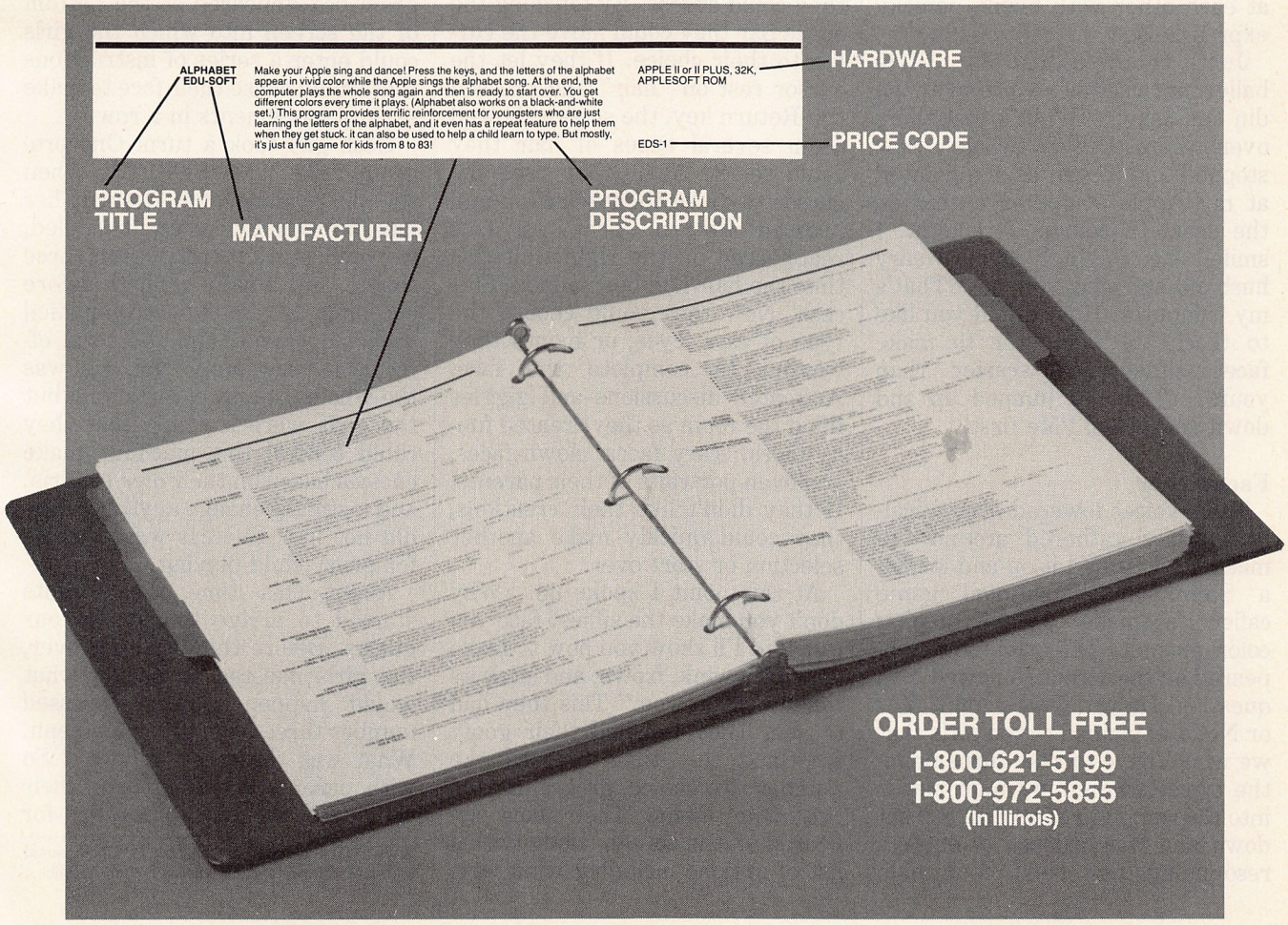

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GAMES/EDUCATION

Spinnaker's Learning Games

Celebrating Halloween in the computer age

by Mary Cron

Picture this, parents. My daughter invites four 8-year-old girls over for a Halloween party. They show up decked out in ballerina and witch costumes and are higher than kites. They had already played all the customary party games, and the party was scheduled to run for another hour. If I didn't come up with something new and exciting for them to do, pure chaos was sure to erupt. As their shrieks and giggles began to rise in decibels, my husband and I looked at each other with blank, panicky expressions.

Just then, a chubby little ballerina raised her voice over the din and asked, "What's that thing over there?" The whole crew stopped and looked as she pointed at my Apple computer sitting on the desk. Of course, I thought. I smiled encouragingly at my weary husband and said to them, "That's my computer. How would you like to teach the computer to make faces sillier and scarier than yours?" They all jumped up and down and yelled "Me first!"

Facemaker

Their voices lowered dramatically as they gathered around the machine. I turned it on and loaded a Spinnaker educational game called Facemaker. In eye-catching color graphics the game title appeared on the screen, followed by a question. Do you want sound? Yes or No? I explained to the girls that we would have to take turns being the typist who enters information into the computer. The first girl sat down and was ordered to enter a resounding Yes. Next, four main menu options appeared: build, program, game, or choice. I explained that they could either build a face, make that face move, play a memory game with their face, or get extra help. They immediately chose number one.

For the next half hour I had nothing to do but watch. The graphics display and instructions on the screen were so easy to follow that the girls were in complete control. On the right side of the screen there appeared an oval shape for the face. On the left was a list of facial features from which they could choose. By touching the space bar they could move the cursor to their choice. If they let the cursor rest on "hair" and pressed the Return key, the screen showed them several types of hair they could select. Again they used the cursor to make their selection and pressed Return. The oval face reappeared on the right, but this time the hair had been added. Success! Now they could choose the type of ears, eyes, or mouth they wanted to complete the face. Animated discussions and giggles filled the room as they created funny faces, scary faces, clown faces, and even portraits of their parents. If they didn't like their creations, they could quickly make another selection or start over.

At this point I spoke up. "Why don't you make the silliest face you can, and I'll show you how to make your face wink, frown, and stick its tongue out at you." This they had to see. They finished their goofy face and this time pressed the number two choice, program, from the main menu. Their face appeared on the screen, along with a list of options including wink, cry, stick out tongue, frown, and ear wiggle. Next to each word was a letter that stood for that movement (for example, W for Wink). Right off the bat, the girls punched T for tongue, and their face made a noise and stuck its tongue out at them. Terrific! They immediately tried all the options, laughing at the actions they were causing their face to perform.

Programming Facemaker

"Do you want to write a computer program for your face?" I asked. "What?" "Us?" "Sure," I said, "Just press the space bar." Introducing children to programming is one of the educational goals the developers had in mind when they created this game. Facemaker gives the children a simple programming language based on facial action words with corresponding one-letter commands. When our typist pressed the space bar, a program box appeared at the bottom of the screen into which the girls could enter a series of instructions that would cause their face to make several movements in a row.

Each girl took a turn. One program read WWCSFTTTS. When the programmer hit Return, her face winked twice, cried, smiled, frowned, stuck its tongue out three times, and finally smiled before stopping. A sound accompanied each movement, and the total effect was very funny. Not only was the whole process entertaining but the girls were learning that they could control this machine, make choices based on their own criteria, and instantly change anything they did not like. Success was possible for every child playing.

About this time the parents started to arrive to pick up our guests. Before they left, however, the girls insisted on seeing what would happen if they pressed number three from the main menu. What was this game anyway? So with parents watching over their shoulders, the girls entered 3 for

Mary Cron is Education Specialist for Professional Computer Marketing Associates in Los Angeles.

game and hit Return. They were given the opportunity to request instructions, which they elected to do. The directions were clear. The computer was going to cause the face to make a series of movements similar to what the girls had been doing themselves. But when the movements stopped, the players had to enter code in the right order representing the movements the face had just performed. Because a sound accompanied each facial movement, the game tested both their visual and auditory memory and was designed to carry over into the development of reading and spelling skills.

The computer was asking us to hit Return if we were ready. Was everyone ready? Okay, let's give it a try. We first saw the face wink and then stick its tongue out. The girls typed in W and T. A quick musical message let them know they were right. Now for three movements and sounds. On we went with the parents jumping right in to help. We reached seven movements and then went to pieces. The face stuck its tongue out at us, and we had to start all over. "That was hard!" the girls said. But I could tell they were ready to try it again despite the challenge and even though it was time to go.

Facemaker, like Spinnaker's other educational games, is based on the premise that learning activities can be fun and with the personal computer can take children beyond the rote learning of workbooks into areas of creativity and problem solving. This hybrid merging of intellectual and recreational activities can occur in informal environments, particularly in the home where the whole family can get involved.

Detective Games

Our family, as well as some neighbors, were involved in the two detective simulation games Spinnaker has produced for ages 10 through adult—Case #1, The Granite Point Ghost and Case #2,

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The Disappearing Dolphin. It took us days to pinpoint the guilty parties and solve the mysteries. The educational intent of these games is to help children learn to take notes, draw maps, classify, and organize information. And the games do exactly that. Younger players may need some adult assistance because no one can solve these mysteries unless they can take meticulous notes, organize information carefully, and draw a detailed map.

We began our quest for truth by reading the case booklet that accompanies the game disk. We discovered that we had a Snoopmobile, a wrist radio, a flashlight, a camera, a pencil, a headquarters, and a Snoopnet computer. We learned directions for driving our Snoopmobile, how to use the space bar for getting in and out of tight places, the facts of the case, and background notes that described each suspect. The booklet also leaves space for Snoopnotes, clues, information from Mr. X, special messages, and two pages for drawing a map.

After reviewing this well-written orientation, we began the game, stopping and continuing where we left off over the course of two weeks. We hopped in our Snoopmobile, traveled to homes to interrogate suspects, to phone booths to call for clues and information, to headquarters to pick up special messages, and too often to the repair shop because we crashed our Snoopmobile. One thing the little brochure didn't tell us was that the stop command was not instantaneous, a condition referred to as "bad brakes." The game play was challenging. We felt that we had a hundred things to do and keep track of at once. Finally, persistence and collaboration won out, and with much celebration, we were able to pinpoint the culprit.

Spinnaker could have done a few things to make these games even better, especially for the 10- to 13-year-old age group. I liked the fact that the games encourage experimentation by not specifying every step to make beforehand. However, it would have been helpful if the documentation had clarified what you had to accomplish before you could solve the mystery. For example, before you get a confession from the guilty party, you have to: (1) take careful notes using your Snoopnote pages; (2) make a map so you know how to find the phone booth, headquarters, and each suspect's house; (3) find the culprit by using clues to eliminate innocent suspects; and (4) once you know the guilty party, establish the motive.

Story Machine

Story Machine, for ages 5 to 9, was developed around an impressive and potentially exciting educational goal: to enable children to write their own short stories that are graphically animated on the screen as the children write. The game includes a word list that kids can choose from, either displayed on the screen or listed on a reference card. The documentation booklet also sets the rules for the way the words can be used to form sentences.

The story-writing option appears on a split screen with the bottom portion reserved for writing. The graphics related to the story appear in the upper portion as the words are typed. Hitting the Escape key runs the whole story with its graphics. The children can also save their story on disk before they begin a new one. The booklet is clearly written, with instructions and a note to parents listing educational benefits.

I certainly agree in principle with the intent of Story Machine. However, I feel the program falls short of its goals because of the limitations placed on children when they are creating a story. Once again I had my daughter invite her 8-year-old friends over to try some story writing. The following is a sample record of the sentences they entered as they attempted to write a story.

Sentence	Result
The cat sings to the tree.	Worked
The cat runs to the girl.	Did not work
The cat runs.	Worked
The cat is at the house.	Worked
The cat dances.	Worked
The cat hops by the fence.	Did not work

Sometimes a sentence did not work because of lack of space or too many actors on the screen. Other times the words we typed in were simply crossed out, and we weren't sure what the problem was. By the end of an hour the girls were more frustrated by their failures than excited by their successes. They felt certain they could have created

At a Glance

In General:

Type
Informal learning games

Manufacturer
Spinnaker Software Corporation
215 First St.
Cambridge, MA 02142
(617) 868-4700

Format
5¼-inch floppy disks

Computer
Apple II or IIe and Atari 800 with 48K-byte RAM (random-access memory); IBM Personal Computer and Commodore 64 with 64K-byte RAM

Specific Programs
Facemaker, ages 4 to 12, $34.95; includes 7-page booklet for children and parents

Story Machine, ages 5 to 9, $34.95; includes 11-page booklet for children and parents

Snooper Troops Case #1: The Granite Point Ghost, ages 10 and up, $44.95; includes 34-page Snooper Troops Notebook

Snooper Troop Case #2: The Disappearing Dolphin, ages 10 and up, $44.95; includes 34-page Snooper Troops Notebook

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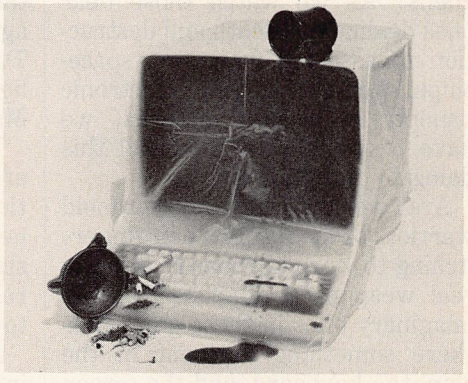

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much more exciting stories without the computer. Before leaving they asked to play Facemaker.

For the purpose of this review, I asked a wide range of parents to describe what they were looking for when they went shopping for a computer game for their children. They indicated it would have to be interesting and entertaining and have more educational value than improving hand-eye coordination. The game would be appreciated more if it were designed for a broad age span so that many family members could enjoy it and if it could accommodate more than one player. Finally, they would look for a price less than $50. Spinnaker has produced a number of games targeted to this home audience, three that I feel are very successful. Designing a silly face or climbing through a window to gather clues gives children and their parents a chance to exercise their problem-solving skills and have a great time in the process. □

GAMES/EDUCATION

Discovery Games

A welcome alternative to zap-'em-dead games

by John O. Green

Haven't you felt an occasional twinge of anxiety watching those sweet little innocent faces hovering over the keyboard or game controls, staring into the screen and blasting away at hordes of invading aliens? As we watch those dear ones dealing out death and destruction to assorted monsters, spaceships, tanks, and the electronic panoply of enemy materiel, we have to wonder: What is all this doing to our children?

Are we training the paranoid warriors of the future, their fingers itching to work keyboards wired to real weapons as diabolical as the imaginary ones in these games? Is there something inherent in the chip, the keyboard, and the screen that makes them primarily suited to war games? Or is the urge in us? (I confess—I enjoy those war games as much as the next kid.)

Well, Children's Television Workshop (creators of "Sesame Street") and Apple Computer Inc. have released 16 alternatives to these zap-'em-dead games. In the new Discovery software, no one or nothing gets exploded, eaten, or otherwise destroyed. In the paddle games, the graphics you aim at are likely to blossom, smile, or do a little dance for you—but never blow up or die. And best of all, the children I observed playing these games seemed as enthralled and delighted as their counterparts who pop off aliens.

The Discovery Games come in four separate packages, each containing one disk aimed at different age groups: Ernie's Quiz (ages 4 to 7), Instant Zoo (ages 7 to 10), Spotlight (ages 10 to 13), and Mix and Match (for the whole family).

Each package includes a booklet of clear, easy-to-read documentation—which you probably will never need. Included in the instruction booklets are a number of related games and simple activities to do without a computer.

A prefatory Note to the Parent in each booklet claims that the Discovery Games have "fail-safe" instructions and a controllable pace, emphasize constructive play, and avoid sexism. By and large, these claims are justified. Once you have the menu on the screen, the programs walk you through each game in the gentlest manner possible, which makes these games an ideal introduction to the computer for newcomers. On the other hand, people experienced with computers and computer games will probably enjoy trying out the Discovery disks a few times but may prefer more sophisticated software.

Education Spelled Fun

The games offer a friendly introduction to the basics of computer use: loading disks, choosing from a menu, operating the Return key, answering prompts, and so on. Other skills that are enhanced include counting, reaction time, spelling, word recognition and reading, typing and elementary text editing, elementary logic and reasoning, as well as imagination and creativity.

However, the games' emphasis is on play. Two of the four packages reviewed here feature the world-renowned Muppets of "Sesame Street," and each disk has a nicely varied selection of games.

The children I watched play—Meggie, Matt, Kerry, Phin, Ann, and Amy—covered the full range of ages, from 3 to 13. I also tested the games with a number of former children in their late-twenties to mid-thirties.

We tried the games on a number of system configurations including an Apple II Plus, IIe, and III in emulation mode. Paddles are necessary for one of the games on Ernie's Quiz and two of the games on Spotlight. The color graphics are gorgeous and important to some of the games, so you should have a color monitor or an RF (radio frequency) connector for your color TV.

What follows is a brief description of the games in the four packages, with a longer treatment of the games most popular with the groups I observed.

Ernie's Quiz

The first game on this disk is Guess Who, in which the player tries to identify Muppet faces as they are slowly blocked in on the screen. Jelly Beans is a straightforward counting game for the youngest players. In Face It, you can

John O. Green is a freelance writer living in Menlo Park, California.

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build some very funny faces with a game paddle—it's a computer-age version of the venerable Mr. Potato Head.

The title game, Ernie's Quiz, is the star of the set—at least for the children I tested it with. The various Muppets in this game—Ernie, the Count, Grover, and Cookie Monster—introduce themselves one by one. Then the graphics disappear and out from screen-right slides a clue such as, "I like to play jokes on my friends." You guess which Muppet the clue describes by choosing from a list of three Muppets at the bottom of the screen. If you guess wrong, you hear a little thumbs-down jingle and your wrong guess is eliminated. Then a new clue slides out.

The correct answer gives you the image of the Muppet and a brief congratulatory message from him—in character. Oscar says something like, "You guessed right, now leave me alone." Cookie Monster begs you to feed him cookies and instructs you to type in the number of cookies you want to give him. In fact, you can't get him off the screen until you feed him. Children who are feeling stingy and stubborn can wait him out, and he'll eventually settle for one cookie. When the child types in Cookie Monster's cookie allotment, the game shows an animated sequence of him eating the cookies one by one—a touch the youngsters found hilarious.

With this age group (4 to 7), we found it important to have an older child or adult to help with the reading and typing. Kerry (age 6) had difficulty with the keys when we ran the games on an Apple III because the letters and numbers repeat when the key is held down too long. But even 3-year-old Meggie could play this game with the help of an older child working the computer (Meggie did learn to press Return rather well).

Instant Zoo

The title game, Instant Zoo (ages 7 to 10), is another guessing game much like Guess Who. This game seemed a bit young for the stated age group, although 4-year-old Matt liked it a lot.

In Mix and Match, players create such absurd creatures as Cookskar Bird and Oskarkienie.

In Star Watch the player watches a field of stars, and as soon as one moves (becomes a "shooting star"), the player strikes the space bar to stop it. The program measures the player's reaction time in seconds and hundredths of seconds. This game was the favorite on this disk among the younger players.

Quick Match is a word-recognition game that also tests reaction time. Adults playing at the hardest level found this game challenging. It was quite possible to score less than 5 right out of 10 tries.

The fourth game, Scramble, proved the most popular among the older children and adults. In this game a cartoon graphic of a jogging shoe assembles a garbled word by walking it in letter by letter. You type in your guess at the bottom of the screen. If you can't guess it, the word is reassembled in a slightly less garbled fashion. The program scores you according to how fast you guess the unscrambled word.

This game builds typing, spelling, and text-editing skills. Amy, age 13, enjoyed Scramble although she was frustrated that her hunt-and-peck typing held her back from getting a good score even when she could quickly identify the right word. This game was quite difficult for Phin, age 7. Some of the words were very hard for him, and if he finally did recognize a word, his typing was so agonizingly slow that he didn't have time to finish it. Parents could solve this problem by going to the Word Editor program (included on this disk) and assembling an easy word list for the youngest players. The level of difficulty could likewise be increased by using Word Editor, a feature that significantly adds to the educational worth of the disk.

Spotlight

The four games in this set (for ages 10 to 13) are more challenging. In Reflect, you bounce a light off a mirror (which you control with the paddle) to try to beam the reflected light onto a target, such as a flower which blossoms when hit. The game lets the player make an intuitive discovery of the physical principle that angle of incidence equals angle of reflection.

The title game, Spotlight, allows more sophisticated reflections with two mirrors. You try to nail a peripatetic vaudevillian (named Steve) with the spotlight as he strolls back and forth on the stage. If you hit him, he does a little soft shoe to the accompaniment of a Tin Pan Alley jingle. This game delighted players and was quite challenging. Most could score only about 2 or 3 hits out of 10 tries in their first few rounds.

Hot Stuff, a number guessing game somewhat reminiscent of the board game Mastermind, was not immediately interesting to any of the players I tested it with—save one adult.

Boxed In is a board game similar to the popular game Othello, itself an imaginative variation on the venerable game of Go. You play against the computer at three levels of difficulty. Playing at the hardest level, I beat the machine the first time and lost the second, demonstrating either luck or retrograde learning.

Mix and Match

The title game, Mix and Match, proved a great favorite with the 4- to 7-year-olds. In this game the program lets players mix the heads, bodies, and feet of six Mup-

pets—with some outlandish results. The program also names your creation by combining the appropriate Muppet names. You assemble such absurdities as Berbird Monster, Cookskar Bird, Big Ber the Grouch, Oskarkienie, and so on. The younger children—Meggie, Phin, and Kerry—had trouble reading the names of these made-up characters but giggled their heads off when an adult read them out loud.

The game Animal became one of my favorites, although the children didn't immediately discover all its charm. The program tries to "guess" what animal you're thinking of, by asking you questions about it. When the program gives up, it asks you to name your animal and describe it a bit. My pleasure here consisted in telling the computer about such well-known creatures as Wabberjacks. I also told it that "pigs can howl at the moon" and that horses eat computers. When the computer dutifully asked me, "Can horses eat com-

At a Glance

Name: Discovery Games: Ernie's Quiz (ages 4 to 7), Instant Zoo (ages 7 to 10), Spotlight (ages 9 to 13), Mix and Match (all ages)

Type
Educational games

Manufacturer
Apple Computer Inc.
20525 Mariani Ave.
Cupertino, CA 95014
(800) 538-9696 or (408) 996-1010

Price
$50 per disk

Format
5¼-inch floppy disks

Computer
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Documentation
Instruction booklets that include related games and simple activities

Audience
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puters?" and then politely said, "Thanks, I'll remember that," I was quite pleased. You can choose to have the program save everything you tell it until next time.

When older children discover the possibilities for making a bit of creative mischief with words and ideas, I think this game will become a favorite.

Layer Cake is a variation on a rings-and-pegs puzzle you can buy in most toy stores. This game is better "in the flesh" and the kids I tested it with were quickly ready to move on.

In Raise the Flag, the player tries to guess the computer's secret word by selecting letters from the alphabet. The little cartoon character who inspects your letter choice is endearing (according to a friend who's an English teacher) as he shakes his head or nods assent at your guess. This game also gives you the option of using the Word Editor to form your own word list.

Criticism and Suggestions

I've saved the inevitable gripes section till last because most of my complaints are small points in comparison to the overall excellence of the Discovery Games.

For instance, in the game Animal, a screen prompt asks, "Is it a wild anmial (sic)?"—a spelling flaw probably no one but an old glue-eyed copy editor is going to notice anyway.

Although the instructions for each game are about as clear and friendly as they can be, some of the children I observed became momentarily anxious when they were learning a new game, especially if they didn't read the messages all the way through. What does the computer want me to do? Has the game started or is this still the learning part? Did I just do something wrong? Because nothing can really go wrong and the programs wait patiently for the player to make a move or hit Return, the kids soon relaxed and figured out what to do next.

In retrospect, I think dealing with this kind of anxiety is probably a learning skill in itself, because most new users experience attacks of nerves when first faced with handling the conventions and eccentricities of software.

The suggested retail price of $50 for each package seems stiff when compared with, say, $50 worth of board games or books, but then most software and electronic games seem overpriced right now.

The price being what it is, I'd love to see some system whereby you could custom order your disk, choosing your own four favorite games. Alas, this is no doubt terminally impractical, not to mention bad for marketing.

These small criticisms notwithstanding, my hat is off to Children's Television Workshop for designing these games and to Apple Computer for marketing them. May there be many more to come. □

TECHNICAL TOOL

Hardware Diagnostics for the Home

Two programs that let sick computers test themselves

by Robert Schilling Jr.

I'm sure there's a computer user somewhere who has never known the agony of computer flu. This person has never had an ailing machine with puzzling symptoms such as BDOS Error on A:, or received an Out of Memory message after entering 10 lines of code, or even watched random characters appear on the screen as if by magic. This review is for the rest of us.

Strange things happen to computer owners when their machines fail to operate as expected. With neophytes, the most common conclusion is, "Oh God . . . I broke it! I just knew this was going to happen!" More experienced users understand that computers can be quirky on occasion, so they go searching for the cause. Recurring failure elicits everything from despondent resignation to expletives that would take rust off a truck bumper. The most frustrating part of computer flu is not being able to identify the source of the problem. Is it the system . . . the program . . . a faulty disk . . . (gulp) ME? Unless you have a pretty fair knowledge of your system's operation—and the proper test gear and spare parts—hardware problems can be difficult to pinpoint.

Two companies now market disk-based diagnostic programs that help you locate and in some cases even treat the cause of your computer flu. The first program we'll discuss, Diagnostics II from Supersoft, is available for virtually all CP/M-based computer systems. The second, Master Diagnostics from Nikrom Technical Products, runs under the Apple DOS 3.3. Being disk-based, neither program can help at all if your machine has an advanced case of the flu. If you're unable to get one of these programs running, you're overdue for a visit to your local dealer.

Diagnostics II for CP/M

Diagnostics II, has been designed to evaluate and report on the most common components of any CP/M-based computer system. Included in the program are tests for memory, the microprocessor, disk drive, terminal, and printer.

Robert Schilling Jr. is a contributing editor of *Popular Computing*.

An online help system is available if you need it. A handy quick system test covering memory, disk, and microprocessor functions can be run in less than four minutes on most machines.

The program manual is very professional. It provides straightforward though moderately technical instructions for conducting each test. It also supplies information on the testing method being used. By examining the test methods, it's possible to determine what has and has not been tested and how thorough the tests have been. There's little doubt that this package is targeted at more experienced users.

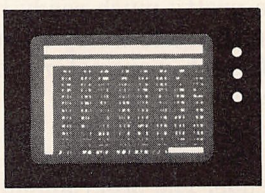
Diagnostics II provides four approaches to memory testing: a quick memory test, a speed test, a walking-bit test, and a burn-in test. As the names imply, each test examines a different aspect of memory operation. Together, they form an exceptionally thorough evaluation of random-access memory (RAM) performance.

The quick memory test is just that—a fast, first-level look that's just fine for day-to-day use. The quick test actually examines two locations in memory, thereby making it less likely that the test will be loaded into a defective memory area.

The speed test measures the memory/microprocessor operating speed. It's actually more of a test of the microprocessor clock-rate accuracy, although it does indicate that both components are functioning together as a unit.

The walking-bit test is potentially so time-consuming that you probably won't use it unless your system shows severe symptoms of memory flu. In the walking-bit test, for example, you select a region of memory to examine (from byte 1 to byte 65,536). The program sets all bits in the region to 0, then changes the first bit to a 1. It then tests every other bit in the region to see if its value has changed accordingly. This process is "walked" through every bit in the region, setting each bit in turn to 1 and testing all others. Then the values (0 and 1) are reversed, and the entire process repeats. The manual cautions that depending on the microprocessor clock rate, it could take up to 13 hours to test a 16K-byte region. Doubling the region to 32K bytes quadruples the time required. (That's right—52 hours!)

The burn-in test runs the same loop of data 65,536 times with a 5-bit block of memory. Then it reverses the value of each bit and tests for incorrect values. A failure indicates an "afterimage" (a cell unable to drop its previous value). Like the walking-bit test, the burn-in test is walked through the



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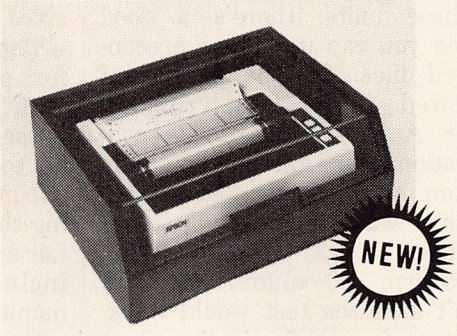

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region being tested. If run on any sizable block of memory, however, this test will be even more time-consuming than the walking-bit test. But the burn-in and walking-bit tests locate failures that the simpler tests just cannot detect. There's really no other way to verify these aspects of memory operation.

The microprocessor test checks Z80 and 8080/8085 microprocessors. The timing, all single-instruction sequences, and many multiple-instruction sequences are tested for correct execution. The program also checks all registers for correct content, even the registers not being used.

The terminal test is expressly for ADDS (Applied Digital Data Systems), Soroc, and Hazeltine terminals. If you have a terminal or built-in display that emulates one of these units, there's a good chance you can use these preconfigured files. On the package I reviewed (which was running under Apple CP/M), these configurations were missing, and a file written for the Apple 40-character display was included instead. Because I was using a Videx Videoterm 80-column card, I wasn't sure the test would work. But it performed flawlessly, albeit in 40 columns. (Diagnostics II includes a program that lets you create your own terminal command-code file for use with other terminals.)

Testing the Peripherals

The advertisements for Diagnostics II indicate that the package is available for virtually all CP/M-based systems. Because disk-drive format, track and sector allocation, and rotation speed can vary widely from one CP/M-based system to another, I was curious to see how the Supersoft programmers had dealt with this mishmash. Not surprisingly, they went for a compromise.

The most serious compromise in the Diagnostics II **disk-drive test** is its failure to measure drive speed (or to mention the limitations of the testing provided). Faulty drive speed is a common source of disk errors and requires only a simple adjustment on most systems. Because of the variety of disks and disk drives on the market, you must know enough about your drive specifications to supply the correct number of tracks and sectors to be tested. Defaults for this test are set to the smallest possible disk capacity. If you're not familiar with your drive's format, there's a fair chance that it will not be thoroughly tested. In the hands of a knowledgeable user, however, the drive test is pretty comprehensive.

These packages can provide your first line of defense against the agonies of computer flu.

The disk-drive alignment test is for purists who aren't satisfied with the basic drive test and who possess the tools and training needed to align drives. Buried in the documentation is a section revealing that drive alignment requires a fair amount of additional hardware, including an oscilloscope, a manufacturer's alignment disk, and other special tools.

The printer test is a fine program for evaluating and monitoring your printer's performance, particularly if it happens to be (or emulates) a NEC, Qume, or Diablo daisy-wheel printer. For standard printers, you're able to test all 96 printable ASCII (American National Standard Code for Information Interchange) characters (including lowercase), the 64-character uppercase set, or a character set of your own definition. If you have one of the three aforementioned letter-quality printers, you can also run a whole battery of tests, including tests for line-spacing accuracy and proper tab positioning.

Overall, Diagnostics II is a high-quality system-assessment package, one that I can recommend with confidence. To use all the package's features, however, you'll need a basic understanding of CP/M, hexadecimal coding, and your system's memory configuration. If your terminal is not a Hazeltine, Soroc, or ADDS, you'll need to stay glued to the instruction manual as you define the screen display control codes. If you're new to computing, don't let these "techie" prerequisites discourage you. Just seek the help of your dealer—or a friend with more technical expertise—the first time you use Diagnostics II.

Master Diagnostics for Apple

Unlike Diagnostics II, Master Diagnostics is designed for specific computer systems—the Apple II, II Plus, and IIe. This means that its tests are pretty much ready to run; you don't have to worry about all the different parameters of CP/M systems.

Master Diagnostics lets you select the various tests from a series of menus. The programming is slick, with some flashy screen displays that put pizzazz in what otherwise would have been just a fine test package. Every menu includes a help selection explaining the choices in that section. Another bit of programming wizardry lets you scroll the help screens one page at a time, in both directions. If they do nothing else for you, these features assure you that the programmers were very familiar with the inner secrets of the Apple.

The program's documentation is well organized and chock full of information explaining how you, the humble computer owner, can make simple repairs and system adjustments. The manual is also very clear about the diagnostic tasks that you should either avoid or undertake with great care. Still, the documentation lacks a few re-

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finements that would have made it first-rate. It has no index and no table of contents, forcing me to thumb through it to relocate material. (Fortunately, the manual is short enough to keep this from being a serious hassle.) Also, it offers virtually no explanation of the methods of testing being used, which leaves you in the dark about which kinds of errors the program can detect. With a bit of digging, I was able to unearth a few answers and make a few speculations, but documentation is definitely an area that needs improvement.

The memory test is a two-part procedure. The first test writes data to an address, then checks the cell's contents for accuracy. The second test ensures that the data has been sent to the correct address (by checking every hexadecimal address that's only one bit different from the intended address). The documentation doesn't tell you what happens if the memory test gets loaded into a faulty memory area. But all things considered, the RAM test is a good one, offering speed and a thorough first-level assessment.

The disk-drive data-storage test determines whether data can be written by the drive on a particular disk track and sector and if the same data is read back again. You should be aware that all commerical diagnostics packages share a common limitation: the disk drive can be tested only against itself. You cannot test an alignment standard without a second drive (known to be good) or an oscilloscope and alignment disk. A drive, for example, could pass the tests provided by either of these packages and *still* be out of alignment. The misalignment would be the same during the write and read operations; thus the drive would appear to be functioning properly. However, the drive might not read or write to disks prepared on another drive.

The drive-speed test, explained with imaginative illustrations in the manual, lets you adjust disk-drive speed. Drive-speed measurements vary a lot depending on the disk being used in the drive. If you want to get an accurate setting, select a disk that doesn't sound like it's snagging in its jacket (one that doesn't sound like someone running in a brand-new pair of corduroy pants, in other words).

The monitor test includes some general instructions on adjusting the screen display. This test was designed for Apple 40-character displays, so it won't be terribly useful if you've got an 80-column card. In the event that you can't make adjustments without dismantling the monitor, the Master Diagnostics manual tells you how to remove the monitor's back panel so you can tweak its controls.

Because of my many years of experience in the TV repair business, I'd like to amplify the manual's safety warnings. There are *lethal* voltages inside these units. In addition to the power line from the wall socket, the transformer that supplies your TV or monitor's picture tube generates 25,000 volts. The voltage is regulated, meaning when you touch the transformer and the voltage begins to drop, the supply will try to bring the voltage back up to 25,000.

The manual also explains how to make adjustments to the yolk, the unit that circles the picture-tube neck. The documentation fails to note, though, that the picture tube is under high-vacuum pressure and the glass on the tube neck is thin. Should you break the glass, the tube will implode and could cut you severely. The bottom line here is if you aren't sure of what you're doing, don't do it!

The Hayes Micromodem II test is a nice extra. Many Hayes owners turn purple when downloaded data vanishes in a haze, and this test makes sure your modem is functioning properly.

The Master Diagnostics package covers almost every Apple II function that can be evaluated without sophisticated test gear, and the manual tells you how to make the repairs and adjustments that the tests indicate are needed. It certainly qualifies as a friendly package, one designed for use by both nontechnical and technically adept computer owners (monitor-adjusting excluded).

And, in the spirit of those late-

At a Glance

Name: Diagnostics II

Type
Hardware diagnostics for CP/M systems

Manufacturer
Supersoft Inc.
POB 1628
Champaign, IL 61820
(217) 359-2112

Price
$125 ($15, manual only)

Format
Most CP/M disk formats

Computer
Most CP/M-based systems with 32K-byte memory

Documentation
38-page manual and help screens

Audience
All who use CP/M-based systems (some technical understanding helpful)

Name: Master Diagnostics

Type
Hardware diagnostics for Apple II, II Plus, and IIe

Manufacturer
Nikrom Technical Products Inc.
25 Prospect St.
Leominster, MA 01453
(617) 537-9970

Price
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Format
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Computer
Apple II, II Plus, and IIe

Documentation
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Audience
Any Apple II, II Plus, and IIe user

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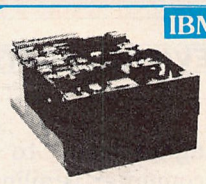

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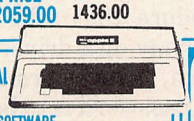

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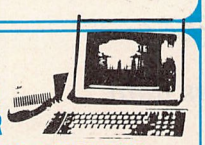

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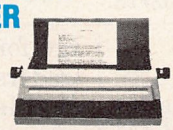

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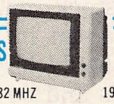

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Computer repairmen are about as reluctant as MDs to haul themselves out of bed at 2 a.m. for house calls. That's why self-diagnostics is something you shouldn't shrug off—especially if your system has been felled more than once by computer flu.

Of course, it's difficult for the amateur diagnostician to tell whether his computer is ailing or, uh, terminal. "Dubious Diagnostics" is how many computer users would describe these programs that enable sick machines to test themselves. But if you're looking for a first-level diagnostics package—that first line of defense that might keep you out of the repair shop—these packages are attractively priced and do the job. A job, I might add, that's seldom tackled by computer owners who know, in their heart of hearts, that once the hardware goes down, there goes the ball game! □

BUSINESS/HOME

Dow Jones Market Analyzer

This financial tool lets you retrieve Dow Jones data and print customized charts

by John Edwards

In 1882 newspaperman Charles Henry Dow and two associates founded Dow Jones and Company Inc., a news agency for the financial community. One of the company's first projects was a newsletter targeted at investors. One hundred and one years later, Dow Jones is still in the financial news business, although computers are revolutionizing the format and delivery of that information.

One example of this tranformation is the Dow Jones News/Retrieval Service, an online database that includes current market prices, a corporate earnings estimator, periodic news updates, and dozens of other items. But while the service can potentially be a great boon to investors, it's all but useless unless the person tying into the system has a way to apply the wealth of data to his particular needs.

One remedy is the Dow Jones Market Analyzer—a software package for serious investors or stock traders. The Market Analyzer enables telecomputerists to retrieve quotes from the Dow Jones service, store the data on disk, and later update that information automatically. Users can also chart the accumulated information numerically and graphically for use in market research.

In the jargon of Wall Street, the Market Analyzer is a "technical analysis tool." For those not familiar with the term, technical analysis is a method of predicting the future path of a stock by studying its history. By looking at the track record of a specific stock—or a related family of stocks—an investor with a keen eye should be able to spot certain trends and be prepared to act upon them when the time is right. Technical analysis is a somewhat controversial way of picking stocks (as opposed to examining each company's balance sheets, earnings statements, and the like) but one with its share of proponents.

Start-up Is Simple

At present, the Dow Jones Market Analyzer is available only for owners of Apple computers. To fully exploit the system's many features, prospective users must have access to an Apple II, II Plus, or IIe (or an Apple III in its Apple II emulation mode) with a minimum of 48K bytes of random-access memory (RAM), a disk drive (a pair of drives eliminates a lot of disk swapping and generally makes life a lot easier), a color monitor, a printer, and either an RS-232C communications interface, a Super Serial Card, or a Hayes Micromodem.

Day-to-day operation of the Market Analyzer is remarkably simple for a program that aims to conquer such an intricate area of research. After going through a short set-up procedure that tells the program how many disk drives, what sort of modem, which printer slot, and what password is to be used, the investor is ready to put the system to work.

The documentation includes a lesson that takes the novice through a typical Market Analyzer operating session. The instructions show the software owner how to transfer, or download, the various market statistics from the News/Retrieval service to his own computer system.

One of the Market Analyzer's major pluses is the fact that it's totally menu-driven: nine separate menus take you through each step of the program and provide options at every stage. The first program feature a new owner is likely to use is data maintenance—adjusting for stock splits, alphabetizing a stock list, and performing a number of other portfolio maintenance chores. Market Analyzer can handle information on common and preferred stocks, corporate and foreign bonds, mutual funds, and stock options. It can store data on 104 stocks for 128 days or 52 stocks for 256 days on a single disk.

John Edwards is a contributing editor of *Popular Computing* who lives in Glendale, New York.

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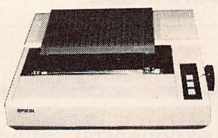

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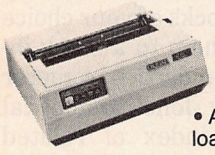

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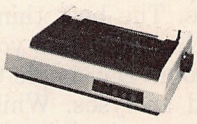

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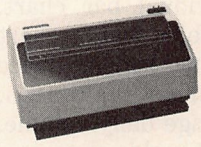

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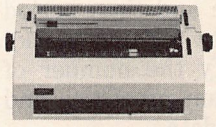

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Designing Charts

The Market Analyzer's most powerful feature is its ability to generate an impressive array of charts. Among the graphic representations it can create are stock bar charts and relative strength charts. These charts can reflect the performance of individual stocks, compare stocks against other stocks, and compare stocks against investment indexes.

Market Analyzer doesn't promise to turn penniless hobos into wheeler-dealers overnight.

The basic kind of chart generated by the Market Analyzer is, of course, the individual bar chart. The program enables you to chart securities data that reflects price range, daily price valuation, volume, and average daily volume. To begin the chart-making process, you select the Dow Jones abbreviation of the stock you want to examine. The computer then prompts you to type the number of time units to be displayed (each unit can represent a date and time period you collected data for that stock). After you specify the number of units, the program processes and charts the stock data.

Keeping user convenience in mind, the Market Analyzer also offers an auto-run feature that automatically executes a sequence of charts and statistical analyses that you preselect from a group of individual charts. You can save the sequence on a data disk and use the auto-run feature to automatically update the sequence whenever you use it. You can also insert pauses into the sequence that let you fully analyze one security before proceeding to the next one. On the whole, this feature gives you an efficient way to analyze your portfolio with a minimum number of keystrokes.

In addition to producing simple bar charts with the Market Analyzer, you can also generate more complex charts by entering the system's flashing-caret mode (named after the blinking cursor that appears on the screen when you select the option). With the flashing caret, you're able to perform a wide range of stock analyses: computation of simple moving averages, weighted moving averages, exponential averages, volume indicators, and more.

Simply put, the flashing-caret mode is the heart of the Market Analyzer program. It's here that an investor can pick apart the individual charts and view them from almost any angle. The best thing about this mode is that it lets you run the gamut from very simple to very complicated analyses. While it's possible to get mired in detailed analyses, you can also use the flashing caret to chart something as simple as the volume of shares traded during a given week. For a more inquisitive user, however, the flashing-caret mode contains a user-jump routine that enables the programmer/investor to add some of his own secret formulas to the program.

Comparison Charts

While analyzing individual stocks is necessary and useful, a truly successful technical analysis requires comparing two or more stocks against each other. To its credit, Market Analyzer handles this task quite nicely indeed.

The system provides two techniques for comparing different stocks or stock averages over time: regular comparison charts and relative strength charts. With either option, you can graphically compare up to five values with the help of the Apple's high-resolution color graphics. One sour note: stock averages like the Dow Jones Industrial Average or Standard & Poor's 500 must be entered into the system by hand; Market Analyzer cannot automatically enter these values.

As with individual charts, the comparative charts measure stock value (or stock averages) on a time-unit scale of your choice. The more quotes the software has to base its chart upon, the more precise the chart will be. If you select stocks with different time units, the system defaults to the smallest number of time units among the stocks chosen. (For example, if the LBJ Company has entries for 25 time units and the JFK Corporation has entries for only 17 units, the stocks are compared on the 17-unit scale.)

The second technique for comparing stocks and stock averages—relative strength charts—works by taking several stocks of your choice and comparing them to a stock index, either a standard barometer such as the Dow Jones Industrial Average or an index of related stocks that you create. In either case, the system calculates the ratio of a stock price divided by the index and tells you the stock's percentage change in relation to the index. For example, if the stock price has decreased by 10 percent while the index decreased 20 percent, you can at least be reassured that your stock has done better than average during the period in question, even though your stock has fallen in price.

While Market Analyzer presents charts on the computer's display during execution, you'll probably also want to print out hard copies. The Market Analyzer plots its charts with a variety of line fonts, including horizontal lines, parallel lines, and trend lines. Besides giving you charts with many different looks, these lines also make one stock easy to distinguish from another in comparison charts.

I used two printers to generate graphs: an Epson MX-100 and an Okidata 82A. A Grappler Plus printer interface connected the computer and printers. Regardless of the type of line I used, both printers made charts that were crisp, clean, and easy to study. The

only irritations were the lack of a full legend (requiring that you manually note which plot represents which stock) and the fact that it can take up to 10 minutes to print a chart. Because of the lengthy printing times involved, you'll almost certainly want to use a printer buffer that will let you continue to operate the Market Analyzer while the printer is merrily grinding away.

Dow Jones EZ Terminal

Supplied with the Market Analyzer package is a membership to the Dow Jones News/Retrieval Service, plus one hour (nonprime time) of free use of the service. Market Analyzer owners not familiar with the news retrieval service will probably want to poke around on it awhile before actually downloading data into the computer. Whether accessing Dow Jones for data to feed into the Market Analyzer or just looking to see what news the *Wall Street Journal* has to offer, you'll find the Market Analyzer's automatic log-on to the Dow Jones News/ Retrieval Service—dubbed Dow Jones EZ Terminal—to be quite convenient.

To take full advantage of the EZ Terminal's automatic log-on capabilities, you must have a Hayes Micromodem connected to the Apple. With the Micromodem installed, all it takes is a single keystroke to automatically dial and hook up to the news service. If you don't have a Micromodem, EZ Terminal also lets you sign onto the service manually.

Once you're logged on, EZ Terminal acts like any other communications program. Among its primary features are a print buffer option and, of course, an ability to download data to disk. The terminal is so complete that you may even want to use it for accessing local bulletin boards and other databases.

Blue-Chip Documentation

The documentation accompanying Market Analyzer can be de-

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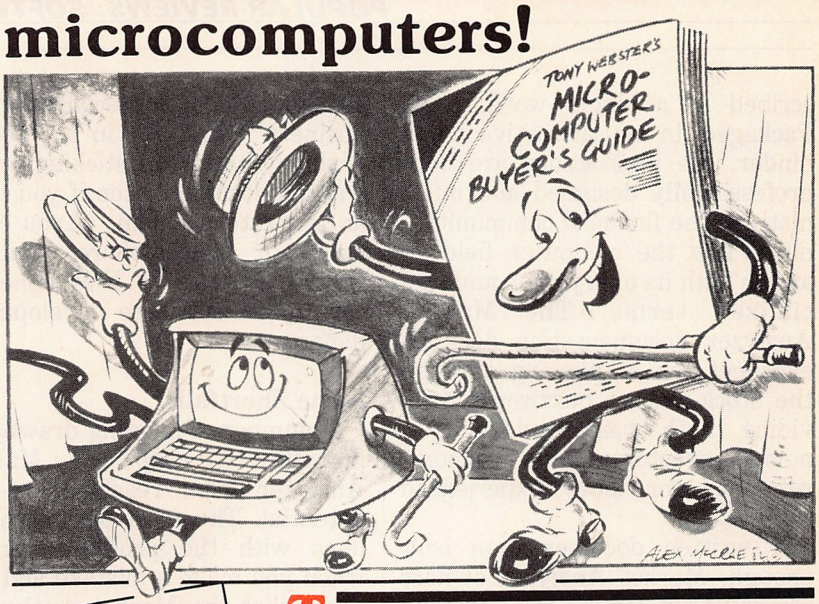

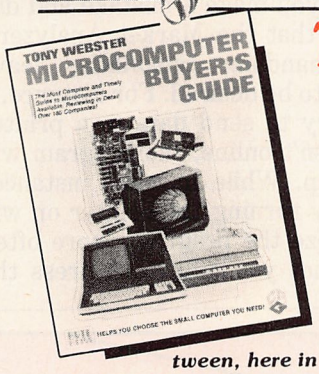

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scribed in a single word: slick. Packaged in an attractive vinyl binder, the instructions are both professionally designed and informative. The financial community—much like the computer field—is awash with its own jargon and specialized terms. The Market Analyzer documentation does an excellent job of plowing through the stock-market buzzwords, providing both basic guidance to novice investors and a memory-refresher for more experienced traders.

If written documentation isn't enough, Market Analyzer owners can call Dow Jones's toll-free telephone hot line. I placed several calls and found the hot-line assistance to be friendly, although not terribly edifying. The advice tended to be fairly general, and questions of even a slightly technical nature usually stunned the hot-line operator. The number was also busy a lot, especially during business hours. All in all, you're probably better off sticking to the written documentation if you have an intricate problem. If you can't find your answer there, then try writing a letter to Dow Jones in care of its software development department.

Some Shortfalls

A number of nagging drawbacks manage to keep the Market Analyzer from reaching its full potential. The most serious problems with the program surface when you make a mistake and discover that the Market Analyzer's error-handling capabilities leave much to be desired. For instance, if you try to send data to a printer that isn't online, the program will lock up. While in some instances merely turning the printer on will unfreeze the program, more often than not you'll have to press the Apple's Reset button and reboot the program. Arrivederci data!

Error messages pose another problem. If you happen to get one of these messages while plotting a security, not only will you lose all your data, but your plot will fall off the screen and be lost forever (or at least until you reassemble all the information from disk and try again). Can such a dreadful situation be avoided? Yes—providing you don't make any errors. If you do, be careful lest your tears short out the Apple's keyboard!

A minor problem is Market Analyzer's inability to recognize stock splits while printing or displaying a chart. If the stock you're analyzing has split within the period you're charting, it shows up on the chart as a disconcerting gap. While this bug may not be major, it points to sloppy programming that should be remedied in the program's next version.

Although the program's bugs are annoying, you can work around

At a Glance

Name: Dow Jones Market Analyzer

Type
Stock market analyzer and charting system

Manufacturer
Dow Jones and Company Inc./
RTR Software Inc.
POB 300
Princeton, NJ 08540
(609) 452-2000

Price
$350

Format
Four 5¼-inch floppy disks

Computer
Apple II, IIe, and III with 48K bytes of random-access memory; Hayes Micromodem or Apple 232C card with modem also required

Documentation
101-page vinyl loose-leaf binder

Audience
Stock-market investors (from novice to seasoned)

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them by using common sense and sure-fingered typing. The documentation doesn't compound your aggravation by boasting, either. The company knows that complex market-analysis programs are likely to have a few bugs the first time around, and the Market Analyzer manual makes no promises that this software is perfect—or a product that can turn you from a penniless hobo into Cash McCall in a few days.

Meanwhile, the financial community's debate over the value of technical analysis continues to simmer. If you're convinced that technical analysis is a worthwhile pursuit, then Market Analyzer can be a useful addition to your software library. Despite its minor drawbacks, Market Analyzer probably has Charles Henry Dow rolling over in his grave—rolling over last year's dividends into tomorrow's big gainer, that is. □

BUSINESS

Processing Business Forms

Versaform may be the best way yet to conquer repetitive paperwork

by Robert Moskowitz

A lot of us believed the promise that the coming of computers meant the end of paperwork. We'd have clean desks, up-to-date files, and, no doubt, more time after we made the switch from pens and typewriters to microcomputers. Unfortunately, many of us are still frazzled by stacks of paperwork—much of it generated by *other* computers—piling up on our desks. Versaform, a program that automates the processing of business forms, may be just what we need to get on top of those unending piles.

According to one Versaform user, Darryl Henderson, a small-systems consultant in Calabassas, California, "Versaform is really the first of a new breed of programs for microcomputers: a forms processor that easily adapts to and automates your present forms and forms-handling procedures. A forms processor," he continues, "adds the advantages of a com-

Robert Moskowitz is a business consultant living in Woodland Hills, California.

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puter to your paper-based work, including high-speed sorting and reporting on data in the system."

In one sense, a forms processor is really just a specialized type of database handler. Database programs, of course, enable you to enter information into the computer, save it on a disk, then retrieve it selectively or in toto. You can use a database program to search for, modify, sort, or compile reports on specific information in your database. Many people now use such database programs to do some of the work Versaform does, including printing and keeping track of invoices and purchase orders, inventory records, patient and client information, and so forth.

Thanks to its special features, Versaform easily outperforms general database programs when it comes to processing business forms.

While a form is basically a complex version of a record in a database, with Versaform the record itself can resemble in minute detail the most complex business forms you now use—including your IRS paperwork, medical insurance billing, invoices, purchase orders, and more. And these automated forms can partly fill themselves in too, something no IRS form has ever done for me.

Once you begin to utilize its full capabilities, Versaform easily outperforms any generalized database program because it incorporates many features specifically designed for processing business forms. Among these are automatic checking of input for accuracy, automatic calculation of preset formulas, automatic filling in of dependent variables (such as total price after you've entered amounts for price and quantity), the ability to print information in the blank spaces of existing forms (such as IRS or insurance claim forms), and a mechanism that enables you to designate special-function keys.

Simple Setup

Versaform comes as a general-purpose forms processor without any preset applications. Your first job is to configure the system to your hardware. Versaform works with conventional floppy disks or a faster and larger-capacity hard disk. The display uses the standard 40 columns or virtually any 80-column plug-in card. Versaform's configuration program prompts you for information about your system and makes the appropriate software adjustments. The program adapts to a wide range of hardware, including an Apple II, IIe, and III and IBM Personal Computer, and requires at least 64K bytes of random-access memory (RAM). Because Versaform uses the Pascal programming language and conventions, an Apple II can have nothing in slot 3 but an 80-column card (if you are using one). Anything else in slot 3, I finally discovered, totally jams the system.

Before Versaform can do any work, you must set it up to perform the specific types of forms processing you want. Versaform keeps all the information about each such application on a data disk, so you can set up the program to handle as many different forms—one at a time—as you like.

Versaform provides a set of simple commands, prompts, and menus that let you preset a specific series of computerized operations one step at a time, even with little or no knowledge of formal programming. You'll find Versaform so easy to use that you'll have your first business form set up and handling useful work in less than an hour.

One major advantage of Versaform is that you can prepare specific applications that can then be used by bookkeepers, secretaries, office managers, and others who may have little familiarity with computers. They can quickly learn to use Versaform versions of their paperwork forms without having to know anything about how the program itself operates.

Creating an Application

The first steps in creating a specialized application are to initialize a fresh data disk, establish a new data file, and then design the form you want to use. The design is totally open—you can lay out a form on one or more pages and type in any labels, column headings, or fill-in items you want. You simply move the cursor around the screen with the left arrow, right arrow, Ctrl-O, and Ctrl-L and enter each item exactly where you want it to appear on your finished form. You type in a row of dots to indicate the number of spaces you need for each single-item entry, such as a name, street address, or zip code.

Next, you type in column headings on the line where you want them—all headings must be on the same line—and the computer automatically lays them out across the full width of the form. You can add dots to a heading to leave more room for data in that column.

You select one or two of the items in your form to be the key items. These items, such as an account number or a name and a date in combination, can be different for every form. Versaform uses the key items to create an index for faster data retrieval, sorting, and searching later on.

If you make a mistake in designing the form, you can erase an entry and try again until you have the form just the way you want it. But you have to make these adjustments before you begin entering data and saving it. Afterward, the program does not allow any more structural changes.

Special Entry Functions

In addition to designing the appearance of a form, you can add a lot of behind-the-scenes activity that your computer will manage and monitor as you later use the automated forms. For example, you can preset the computer to check the information typed into a given space on your form. These checks make sure the entry meets criteria you specify for the number of characters and format, type of data (such as yes or no, alphanumeric, or date information), and range of values. You can also list up to 99 acceptable entries for each item on your form (99 different tax deductions, for example), and Versaform will reject an unacceptable entry, provide the appropriate error message, then let you try again.

In addition, you can require that items carrying certain vital information, such as account numbers or pricing information, be filled in before the computer processes the input and goes to the next operation. Or you can require that items be left blank so the computer can make an entry in that position later on. The program even has a check-digit system to help ensure that you've typed in lengthy or complex numbers accurately. Basically, Versaform calculates a check digit for any number you type into its calculator function, then every time you type the number into a form, the computer recalculates this check digit. If you type the number inaccurately, the check digits won't match, and the computer will advise you to check your entry.

Another special feature lets you prepare a reference table that Versaform can use to fill in a form automatically. For example, when you type a part number into a form, the program can use that number to find other data—such as a description of the part, its price, and a discount factor—in several reference tables you've prepared and then add that information where you want it on the form.

Versaform can also carry out automatic calculations for various items on your forms, including totaling columns, figuring applicable discounts, adding sales tax, doing price/quantity extensions, and much more. The calculations can include addition, subtraction, multiplication, division, greater than, and less than. However, each item calculated can use no more than five sequential operations.

In addition, Versaform provides a direct calculation function. A single command engages a direct-entry calculator that enables you to add, subtract, multiply, and divide, as well as round off, change signs, and automatically calculate the check digits for numbers you type in, a process that would be tedious and difficult without computer assistance. You can also bring numbers from the form you are

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processing into the calculator or place numbers from the calculator into the form.

Another way Versaform outperforms most general-purpose databases is with its special-function keys. You can set up an application to interpret any key or control-key combination you type in as something entirely different. All you do is follow the computer's prompts to enter the ASCII (American National Standard Code for Information Interchange) number of the key you want to designate, then enter the ASCII number of the character you want that key to stand for. You do this once when you configure your system, and from then on, the redefined key will be operative every time you use the program.

All these features mean you can fill in a form on the computer and operate your special application with a minimum of effort. But that's only half the story. You'll almost certainly want to transfer information from your files to other people's forms; think of doctors who must fill in insurance claims forms or accountants who must fill in IRS forms. Versaform also has special features that enable you to pull information out of your computer accurately and easily. For example, the Export option lets you transfer data from a report to a disk file for further processing.

Versaform prints a grid on preprinted forms so you can figure out precise coordinates for each blank space you want the program to fill in.

Simplified Printouts

Versaform incorporates in its reporting system a feature that lets you specify the exact column and line where you want specific data printed. On demand, the program prints a grid-like pattern of line and column numbers over any preprinted form you can run through your printer. You then use this grid to determine precise coordinates for each blank space on the form you want Versaform to fill in.

When you design a print format, Versaform goes through each item on the form consecutively. For each one, the program asks whether to print the item, where to print it (line number, column number), and whether to print it anywhere else. The program then asks you to verify the information.

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When you have answered the questions for all items on your form, you can print additional comments wherever you like—up to 250 characters all together. These comments can include any character, and you'll find them useful for such refinements as underlining column totals.

The entire process of designing a print format can take quite a while, particularly if your form has many items. Fortunately, you can save print formats for retrieval and reuse with only a few keystrokes.

Once you think you have the print format correct, you can quickly print a test copy of the form with asterisks in place of all the variable data. If you don't like what you see, you can make changes.

Reporting Functions

Versaform provides the reporting functions you find in most database programs. For instance, you can have the computer search all the forms for those that meet your selection criteria and then display or print some or all of the data from the forms it has selected.

With Versaform, you can include any item on your form in the selection criteria. You can compare the entry in a given item with your selection data to see if it is equal to, is not equal to, contains or does not contain, is less than or greater than, less than or equal to, or greater than or equal to the selection criterion. You can string together several such tests to obtain very sophisticated selection procedures.

The process of selecting items for testing or printing is straightforward. Versaform displays a blank form from your file, and you move the cursor to the item you want. Once you make the selection, you move the cursor to prompt lines on which you type in the appropriate codes that let Versaform know what tests you want performed.

Documentation

Versaform is well documented with a spiral-bound reference manual almost 200 pages long, a tutorial manual, and a 14-page reference summary. The reference manual covers every option thoroughly, is heavily indexed, and has a detailed table of contents so you'll find what you want quickly.

The tutorial manual, which is keyed to a data file on a special tutorial disk, is useful and easy to follow. The reference summary is also good, once you become somewhat familiar with Versaform procedures and conventions. But chances are you'll soon be able to get along with just the on-screen prompts and menus Versaform gives you as it runs.

A Few Quirks

While Versaform is a highly useful program, you should be aware of some problems. First, you can set up the program to total a col-

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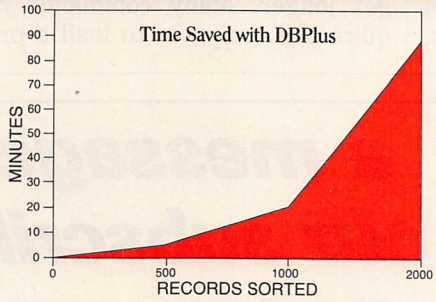

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umn of figures, but if the column runs longer than the space allotted on your form, the program will print or display one full form, then another and another until it has provided room for all the items in the column. In that case, the total for all the items in the column appears as the "total" on each page. This limitation might be acceptable when you're working on the screen, but it's definitely a nuisance when you're working with printed copies.

Another problem is the frequent disk swapping sometimes required to create reports. The program prompts you to swap the data disk, program disk, and the report work disk in various combinations. If you have three floppy-disk drives or a hard-disk drive, you don't have to suffer through this procedure. But most of us will dislike being tied to the computer to perform disk swapping while the program is preparing a report on a lengthy file.

Even though Versaform is well documented, chances are you'll soon get by with just the prompts and menus the program gives you as it runs.

Versaform has a few other minor problems, such as its limit of only 250 characters for comments and constants on a form and its inability to delete a column from a form. The program also runs somewhat slowly, particularly as your files get longer. Many commands require the computer to load a program, then recapture data from the file disk before it even begins processing data.

Versaform's biggest problem is the frozen data structure. Once you establish a form and type in data, you cannot change that form and use it again. Generally, you want the capability of restructuring your existing data files in case your needs change or you fail to anticipate some useful operation. Because you cannot restructure your Versaform applications once they're finalized, I advise you to do a lot of planning before you finally commit your data to a particular application.

One last criticism: Although Versaform works with many clock cards and works well with date information, the program has no provision for pulling the current date into its report formats automatically. Say you want to create a canned report format to check how much

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money is owed to you for more than 60 days, for example, or how much you spent during the past month. To do so, you'll have to call up each report format and manually type in the appropriate date every time you want a current analysis of your data.

Overall Evaluation

No other program—particularly for the Apple II—can match Versaform when it comes to processing forms. When you consider the features and capabilities within Versaform that make data entry easy and accurate, provide for built-in calculations and reference tables, make detailed printouts available even on preprinted forms, and transfer data to other programs for further processing and manipulations, you have to admit this is one formidable system. □

At a Glance

Name: Versaform

Type
Forms processor—a special-purpose database program

Manufacturer
Applied Software Technology
14125 Capri Dr., Suite 4
Los Gatos, CA 95030
(408) 370-2662

Price
$389 for the Apple II, IIe, and IBM Personal Computer; $495 for the Apple II with hard disk and Apple III

Format
Five 5¼-inch floppy disks plus one work disk for reporting

Computer
Apple II, IIe, and III, IBM Personal Computer with 64K-byte RAM and two or more floppy-disk drives; hard-disk drive optional

Documentation
Spiral-bound manual with index; tutorial manual; 14-page reference brochure

Audience
People who want to automate the processing of information contained on such forms as purchase orders, insurance claims, and invoices

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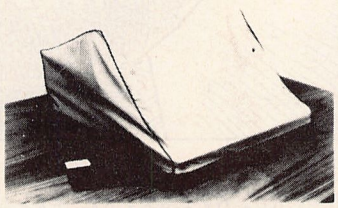

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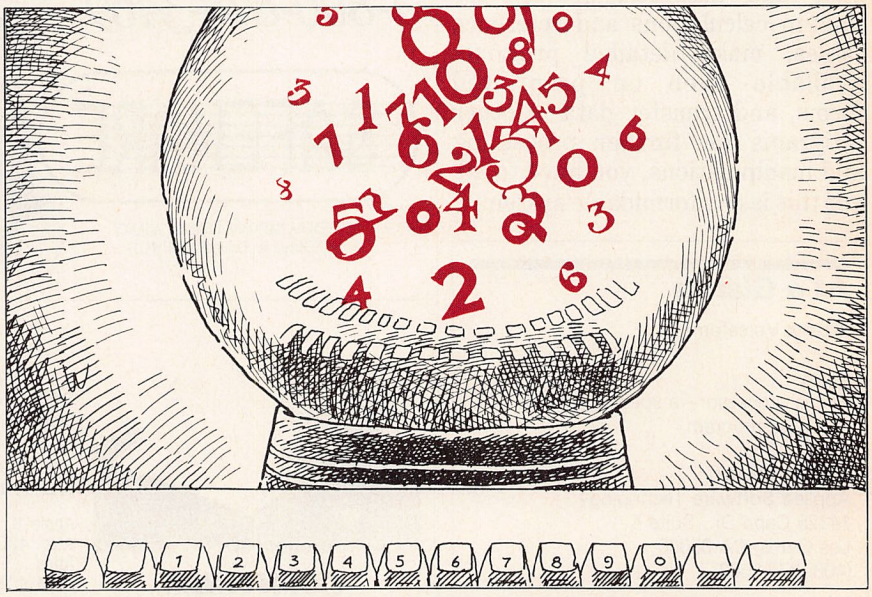
Digital Magic

Use your computer to discover some surprising properties of numbers

by Michael W. Ecker



Have you got a computer handy? How about a calculator? Even a pencil and paper will do for now. I'm going to demonstrate a little mathematical magic for you.

Pick a number from 1 to 6 but don't tell me which number you picked. Multiply it by 999999. If you're using a computer with interpreter BASIC, you can simply type in the BASIC command

```
PRINT your number * 999999
```

and press Enter or Return to see the answer on the next line.

Now take the result and divide it by 7. On most computers, you type

```
PRINT your last result / 7
```

and press Enter or Return to see the answer on the next line.

Now concentrate on the final result for a few minutes, and I'll see if I can read your mind . . .

I'm getting an image of your final result. It contains no 0s. Uh . . . no 3s either. I detect a single 1. Hmm . . . is that a 2? Yes. Now I can make out a 4 and a 5. Now a 7 and an 8. That's it. I've identified all the digits in your answer. Sorry I can't tell you what their order is, but what do you expect from this distance?

Now I'll begin to reveal the mysteries of my clairvoyance. Type in this short BASIC program and run it.

```
10 PRINT "D" TAB(10) "999999 TIMES
   D DIVIDED BY 7"
20 FOR D=1 TO 6
30 PRINT D;TAB(10) 999999*D/7
40 NEXT D
```

See any interesting patterns? Ponder the results. Can you see an explanation for their cyclic (no, I didn't say psychic) behavior? Next month, I'll elaborate on the phenomenon of cyclic numbers. Perhaps you can figure it out before then.

While you're at it, here's another math puzzle for you and your computer to solve. What is the smallest positive integer with the property that when its leftmost digit is moved to the far right, the new number is three times the original number?

To illustrate, take the number 14. Moving the 1 to the rightmost position gives us 41—not quite 3 times 14. We're looking for a number that can be "rotated" to produce a result exactly three times the original number.

Hint: You'll need to treat the numbers as strings, manipulate them with the MID$, LEFT$, and RIGHT$ functions, and then convert them to numbers with the VAL function so you can perform arithmetic on the results.

More on digital magic next

Contributing editor Michael W. Ecker is assistant professor of mathematics of Pennsylvania State University (Worthington-Scranton).

Illustration by Chris Peterson

month. Now for some unfinished business.

More Ado About Interest

Last month we went shopping for interest rates and found that comparing advertised rates requires a good deal of caution and perhaps even some computation—which is right down our alley.

Amalgamated Fat Cats Bank, for example, offers 10.5 percent interest compounded semiannually, while Community Free-Toaster Savings offers 10.25 percent interest compounded daily. Even though Fat Cats appears to have the higher rate, we must compare effective annual rates to be sure.

Last month we showed how to compute the effective annual interest rate using a simple example. Here's the general procedure:

1. Divide the nominal annual interest rate by the number of compounding periods. Call the result I.
2. For the first compounding period, multiply I by the amount of principal in the account. Add the result to the principal to get a new principal amount.
3. Perform step 2 once for each compounding period, then continue with step 4.
4. Subtract the original principal from the final principal. Divide by the original principal. Multiply by 100. The result is the effective annual percentage rate.

Sounds simple enough, but what if we have daily compounding? That means 365 separate calculations just to complete step 2. Of course, if you have a computer, it will take only a few seconds. But wait—there's a faster way to get the answer. We'll present the formula and then give a brief explanation of why it works:

$$A=P(1+\frac{r}{n})^{k}$$

The formula computes the amount of principal remaining (A) after k interest periods have elapsed (r is the nominal annual interest rate in decimal form, n is the number of compounding periods in a year).

Try the formula using a very simple example: an original principal of $1 invested at a nominal annual interest rate of 100 percent ($r=1.0$) with semiannual compounding ($n=2$):

$$A=1(1+\frac{1}{2})^{2} = 1.5^{2} = 2.25$$

If we go to daily compounding ($n=365$) but keep everything else constant, we have:

$$A=1(1+\frac{1}{365})^{365} = 1.00274^{365} = 2.71$$

rounding our answer to the nearest penny. Notice the difference between daily and semiannual compounding!

If we refer back to the manual procedure given previously, we see that our little formula takes care of step 2 all at once. Instead of n separate multiplication steps, we perform a single exponentiation step using the power of n.

Here's a BASIC program to compute the effective annual interest rate. Type it in and find out whether Amalgamated Fat Cats or Community Free-Toaster offers the best deal. Remember to enter the interest rate in decimal form; that is, divide the quoted percentage rate by 100 and use that as the interest rate. For example, if the interest rate is 10.25 percent, you should enter .1025.

```
10 INPUT "ENTER THE ORIGINAL
   PRINCIPAL AMOUNT"; P
20 PRINT "ENTER THE NOMINAL
   ANNUAL PERCENTAGE RATE"
30 INPUT "USE DECIMAL FORM, E.G.,
   FOR 7% USE .07"; R
40 INPUT "HOW MANY COMPOUNDING
   PERIODS PER YEAR"; N
50 A=P*(1+R/N)^N
60 E=(A-P)/P*100
70 PRINT "ACCUMULATED PRINCIPAL
   AFTER ONE YEAR IS" A
80 PRINT "EFFECTIVE ANNUAL INTEREST
   RATE IS" E "PERCENT"
90 END
```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Using this program (or perhaps modifying it), find out how long it takes to double your money at a nominal annual percentage rate of 7 percent compounded quarterly.

Let's go back now to our problem of how to fence in the largest possible area on a fixed budget.

The Thrifty Fence Builder

Last month we used a brute-force method to solve the problem of the thrifty fence builder, and we posed a follow-up problem.

In the original problem, we want to enclose the largest possible area while using two grades of fencing: grade A for the north and south sides costs \$5 per foot; grade B for the east and west sides costs \$4 per foot (see figure 1). What is the largest rectangular area we can enclose for \$400?

If you ran last month's program, you know that the dimensions of the \$400 fence are 20 feet (north and south sides) by 25 feet (east and west sides). It's surprising to note that we end up spending exactly the same amount for grade A fencing (40 feet × \$5 per foot = \$200) as for grade B fencing (50 feet × \$4 per foot = \$200).

In fact, we can generalize the solution: Whenever we want to maximize the fence area for a specified cost, regardless of the relative costs of fence materials or the amount budgeted for the fence, we must spend the identical amount on the fence materials running in the north-south direction as we spend on the materials in the east-west direction! That means no more trial-and-error approaches. A few simple algebraic equations will give us the answer directly.

The follow-up problem is the same except that we don't need to enclose the north side of the area because a natural boundary is located there (see figure 2). With this variation, what is the largest rectangle we can enclose for \$400?

Our generalization still holds: To enclose the largest area, we spend as much on our south fence as we spend on our east and west fences

Thrifty Fence Building Simplified

What's the largest area you can enclose for \$400? A general solution handles all three situations.

Figure 1

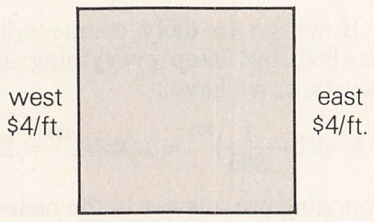


Figure 2

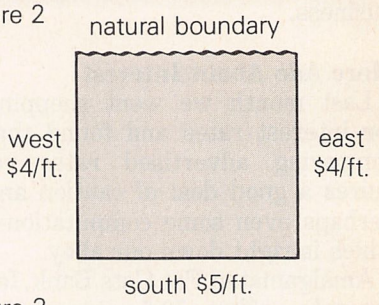
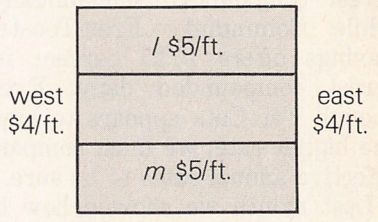


Figure 3



combined. Letting S be the cost of the south fence, E the cost of the east fence, and W the cost of the west fence, we have:

$$400 = S + E + W$$

But since S = E + W and E = W,

$$400 = E + W + E + W = 4E$$

so that E=100, W=100, and S=200. Accordingly, the length of the east and west sides is

\$100 ÷ \$4 per foot = 25 feet

and the length of the south side is

\$200 ÷ \$5 per foot = 40 feet

Our three-sided fence measures 40 by 25 feet.

We've generalized our solution to fences with fewer than four sides. What about fences with more than four sides? In other words, suppose we want to partition the rectangle into, say, three smaller rectangles (see figure 3). Now what is the largest area we can enclose?

Our generalized solution comes to the rescue again. We spend \$200 for the fencing in each direction, which gives us \$50 for each of the sides *s*, *l*, *m*, and *n*; and \$100 for each of the east and west fences. Fifty dollars at \$5 per foot buys 10 feet; \$100 at \$4 per foot buys 25 feet. The outer dimensions of the partitioned rectangle are 10 by 25 feet.

Here's a little BASIC program incorporating all this thinking. It will come in handy whenever you must build a fence using two grades of material (who says mathematicians aren't practical?):

```
10 INPUT "WHAT IS THE COST PER
   FOOT OF GRADE A"; CA
20 INPUT "WHAT IS THE COST PER
   FOOT OF GRADE B"; CB
30 INPUT "HOW MANY SIDES USE
   GRADE A"; SA
40 INPUT "HOW MANY SIDES USE
   GRADE B"; SB
50 INPUT "HOW MUCH CAN I SPEND"; T
60 LA=T/2/SA/CA
70 LB=T/2/SB/CB
80 PRINT "OUTER DIMENSIONS ARE"
90 PRINT LA "FT. GRADE A BY" LB
   "FT. GRADE B"
100 END
```

□

Is there a favorite puzzle you'd like to see discussed in this department? Or maybe you have a better solution to one of the problems I've already covered. Send your suggestions and questions to:

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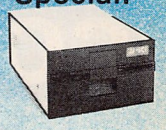

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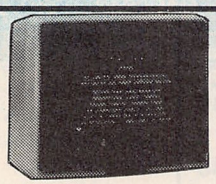

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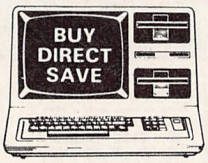

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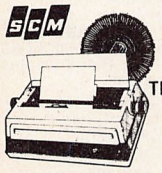

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Knowing What You Need

It's still the best way to brave a trip to the computer store

A 60-Minute Guide to Microcomputers
Lew Hollerbach
Prentice-Hall
Englewood Cliffs, NJ, 1982
137 pages, softcover $6.95

How to Buy a Personal Computer Without Anxiety
Jonathan D. Lieff, M.D.
Ballinger, Cambridge, MA, 1982
113 pages, softcover $9.95

So You Think You Need Your Own Business Computer?
William E. Perry
John Wiley & Sons, New York, 1982
201 pages, softcover $14.95
Reviewed by William Keough

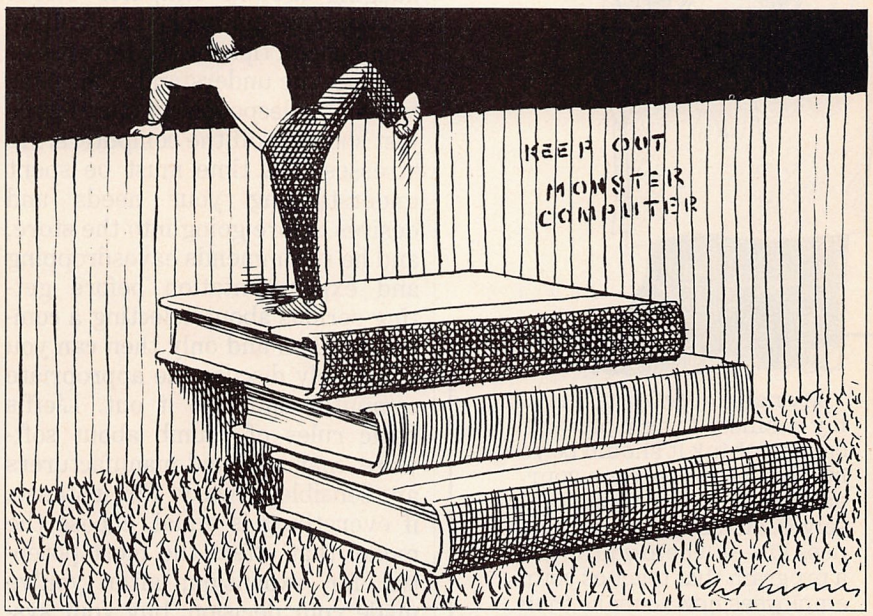

Illustration by Gil Eisner

With prices plummeting and the state of the art continuing to improve at exponential rates, this fresh batch of introductory computer guides comes as a welcome gift to ring out the old and ring in the new. Now the first-time shopper has not only a plethora of hardware and software to sift through but also an expanding library of guides and manuals to furnish valuable background information.

Lew Hollerbach's *60-Minute Guide* has much to recommend it, even if reading it does take closer to two hours than one. The book is written simply but not foolishly, and it does acquaint you with the pertinent terminology and technology so you'll know what computers can do for you, thus preventing you from making a complete idiot of yourself at the computer store. It has a useful index and a glossary of terms such as *cursor* and *daisy wheel* and acronyms such as *modem* (modulator/demodulator) and *RAM* (random-access memory); the definitions are clear and accurate. Also, many of the tips about evaluating and working with various types of systems function as a valuable reference file. For instance, besides offering descriptions of nonimpact/thermal printers, Hollerbach warns that they are not suitable for large volumes of printing and that the paper may be expensive and hard to get.

So, for that certain someone who is in his or her computer infancy, Hollerbach's guide is, as he describes it, a quick course in personal and business computers. It is a good *first* book.

A good *second* book might be Jonathan D. Lieff's *How to Buy a Personal Computer Without Anxiety*. Lieff, a psychiatrist, has taken time off from Freud to write a step-by-step guide for the prospective computer buyer. Unable to find a good layman's guide when he needed one, he decided to fill the void by writing such a book himself.

More leisurely than Hollerbach, Lieff strolls through the world of

William Keough is a professor of English at Fitchburg State College.

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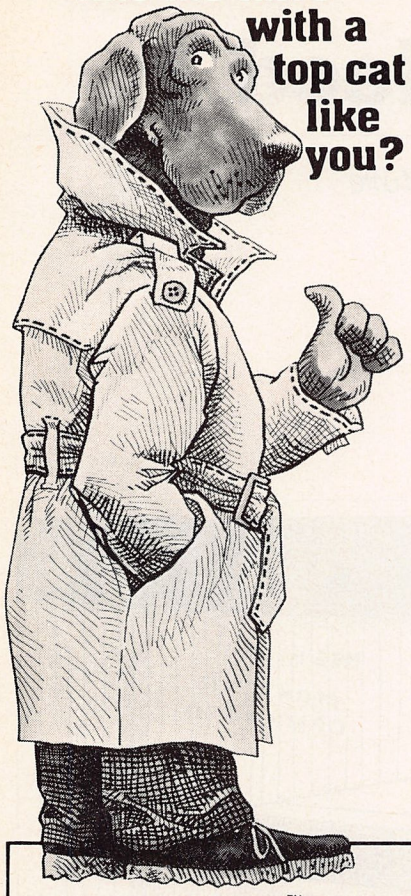

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computers, offering such chapters as "Microhistory" and "Understanding the Monster." While what he offers is technically sophisticated, it is still eminently readable and useful. For instance, he has several incisive pages of the sort of brand analysis that many publications shy away from. He also carefully explains the "trend toward compatibility," the movement of many firms to employ the CP/M operating system so that more software may be adapted to their computers.

As a man who logged many hours hanging around computer stores researching his book, Lieff offers many useful tips for the buyer. For instance, he understands the reluctance of salespeople to spend time just showing off the computers. He stresses that time must be spent understanding your needs and desires before going into the store, and he recommends eavesdropping and experimentation before getting serious about selecting a computer. Then and only then can you effectively discuss the appropriate computer and test it out. Lieff's basic rules of thumb about software, manuals, and manufacturers are sensible, if wary. For instance, if everything is equal, choose the model that offers the most potential for expansion; after you've made your decision, buy your system from the dealer who offers you the most attractive service arrangement.

Lieff concludes with a chapter on new ideas. One of the most fascinating of these is the current laboratory work to develop a new DNA chip that could be implanted in the human brain. A surgeon could thus access his own database during an operation to obtain the latest information on the disease or procedure. How would that, one might ask, fuel the controversy over artificial intelligence?

What then of William Perry's manual, subtitled *The Manager's Guide to Selecting, Installing, and Using the Right Small Computer System*? Well, it is all the title claims and much, perhaps too much, more. Compared to Lieff's breezy, readable book, it is as a boiled egg to a spinach souffle, but a boiled egg might be what managers need.

What is good about Perry's book are the many graphs and checklists assessing business needs and applicability. What is bad about it is that it seems a serious case of overkill—it might take a year just to fill out the questionnaires. Further, the corresponding text is written in the worst sort of jargon I have encountered. It *seems* thorough but may be merely impenetrable.

Small Business Computers, A Guide to Evaluation and Selection

Koichiro R. Isshiki
Prentice-Hall
Englewood Cliffs, NJ, 1982
478 pages, hardcover $26.95
Reviewed by Beverly Cronin

Buying a computer for a small business is not as simple as ordering a new ledger from the stationer. You don't just pick it out, pay for it, and take it home.

Like all smart shoppers, owners or managers of small businesses who want to computerize part or all of their operations go through a research and evaluation process. In such a process you define precisely what you want the computer to do and how much you're willing to spend. This usually involves much reading and innumerable cost-benefit analyses. Then you search out the products that are able to do the jobs you've outlined. This involves no small amount of legwork. The decision to buy a computer surely means that you're in for an extensive fact-finding mission.

Fortunately for those considering small-business computers, many guidelines and sources of information are available. One such aid is Koichiro R. Isshiki's *Small Business Computers, A Guide to Evaluation and Selection*. De-

signed for those on the periphery of the computing field, this book focuses on the management considerations of installing a computer. It's not a primer on computer design or basic operating principles; if you want to get to the nitty-gritty of how computers work, you'll have to look elsewhere. But user-friendly is the key word in microcomputing today; hardware and software keep getting easier to use.

The point is that anyone can learn to use a computer and adapt it to his or her needs. So the real issues are what do you want the computer to do and which one can best get the job done—exactly what Isshiki's book covers.

He explores topics such as the decision to computerize, the basic components of a small-business computer system, the differences among various kinds of systems, analysis of the benefits of computerization, selection of the hardware and software, and the advantages of renting or leasing a computer.

The standard graphs, photos, figures, and checklists all help the reader assimilate the technical information. Potential computer buyers will find the case studies of computer purchases especially helpful. By studying someone else's experiences, buyers can learn what to embrace and what to avoid. A 55-page table listing vendors of small-business computer equipment contains details on hundreds of products. While most prices are probably outdated by now, the basic information (including addresses) remains useful.

Small Business Computers, part of the Prentice-Hall series on data-processing management, is such a compendium of facts and figures that anyone contemplating a purchase will surely want to refer to it time and again. An energetic gatherer of data from a myriad of sources, Isshiki provides potential buyers of small computers with nearly all the information they'll need to steer themselves in the right direction. While the $26.95 price seems a bit high, it's really not too steep as books go. Given all it contains, *Small Business Computers* is worth its price—especially because it could save you a whole lot more.

Executive Planning with BASIC

X. T. Bui
Sybex, Berkeley, CA, 1982
194 pages, softcover $12.95
Reviewed by Bill Lukeroth

Executive Planning with BASIC is a collection of 15 program listings with brief explanations of what they're designed to do and ex-

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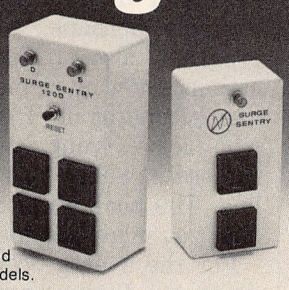

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amples of their use. The programs fall into three basic groups—decision models, forecasting models, and investment models—and range from things like finding the break-even point to discounted cash-flow models and critical-path analysis. For some unfathomable reason, one of the most useful programs is presented in an appendix instead of in the main text; two more appendixes cover matrix mathematics and BASIC keywords (both seem somewhat superfluous).

According to its introduction, the book's aim is to "help data-processing professionals, economists, and managers to understand the techniques of data processing for management decisions." That's the problem—unless you're an economist or otherwise possess specialized knowledge, you're going to have a hard time understanding most of the book. *Executive Planning with BASIC* assumes that you have a rather extensive background in statistics. Consider, for example, the following excerpt:

> *Specifically, linear programming minimizes or maximizes a linear function of several variables (called the objective function or the economic function); this function is subject to several restrictions or constraints in the form of linear equalities or inequalities.*

This isn't an isolated example—the *entire book* reads like this. A glossary is almost a necessity in a book this technical, but none is included.

Executive Planning with BASIC is exactly what the title implies; the author's avowed intent is to give executives a set of tested programs that they can type in and run without having to learn much (if anything) about BASIC. I'm not sure this is possible. In my opinion, getting your money's worth out of this book requires an extensive knowledge of both statistics and business management and at least a minimal proficiency in BASIC. Without the specialized knowledge you probably won't be able to interpret the results of any of the programs, let alone understand what they're supposed to do; without an understanding of BASIC you could have difficulty getting the programs running. It's not that the code is particularly tough (it is well written and easy to follow)—I just question whether someone unfamiliar with BASIC can type in *any* code and get it to work without a hitch or two. The programs are all written for the Apple II, but they look like they could be translated into any other Microsoft dialect with little difficulty.

Another drawback is that some of the programs require an excessive amount of work on the part of the user, in terms of either input or calculations that have to be made before the program can be run. For example, the "optimal queuing" simulation requires you to tell the computer how much you pay your employees *per second.* Why not have the program ask for the hourly rate and then do the necessary division itself? A petty example perhaps, but the same program also requires you to estimate how much money you lose (per second again) from customers who leave your store because they're unwilling to wait in a long line. The book gives no hint as to how you might estimate this.

For the average computer user, *Executive Planning* simply tries to cover too much ground. An adequate explanation of critical-path analysis by itself would probably require a book larger than this one; the same could be said of investment models or simulations. If these programs were presented as part of a five- or six-book series aimed at the layman, they might prove quite popular, but as they are presented in *Executive Planning with BASIC* they are of interest only to a specialized audience. □

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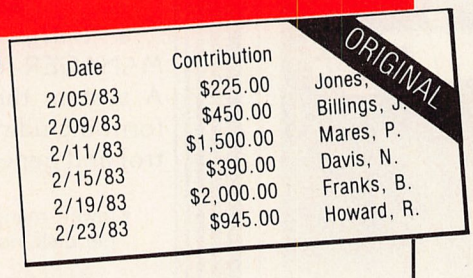

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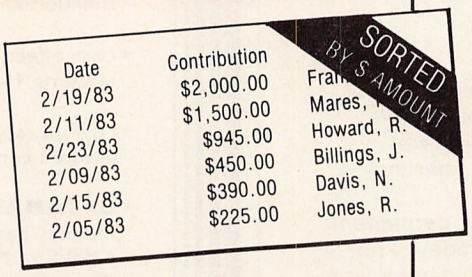

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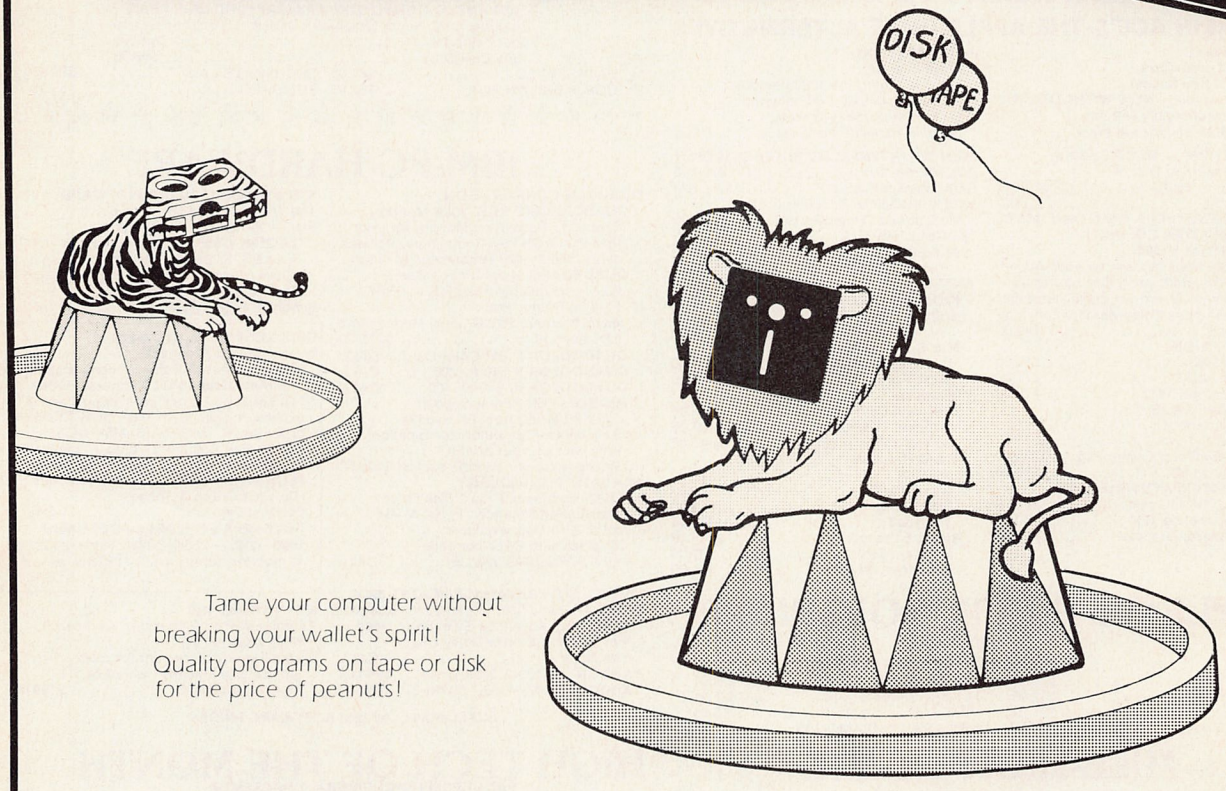

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by George Stewart

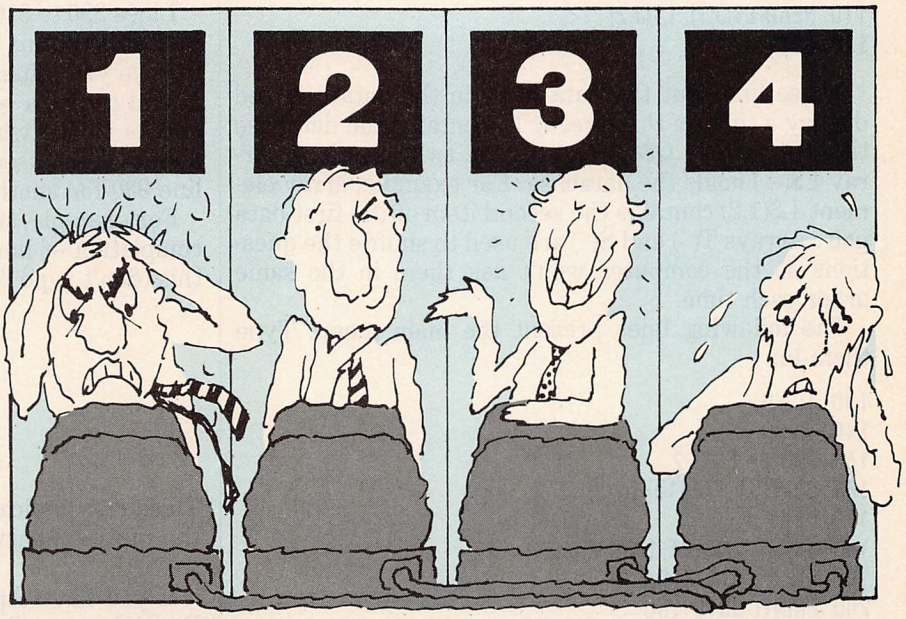

Illustration by Wilbur Bullock

Can you name the capital city of each state? How about the French word for acorn? How many grams are in an ounce? What baseball team won the pennant in 1968?

Just about everybody needs to memorize something from time to time. This month we'll present a program that will help you learn information on any subject you choose. The Quiz Master will ask you questions, check your answers, and keep your score until you have learned as much as you want. The program will even give hints to help as you're learning.

The Quiz Master can "teach" just about any kind of information that involves pairs of short facts: states and capitals, French-to-English translation, English and metric measures, ball teams and pennant years, events and dates, words and their synonyms, words and their antonyms, and so forth.

It's up to you to compile the database that the computer will teach and to construct the questions. In this article, we'll show two sample databases—states and capitals, and foods in French and English.

The database consists of a title, two questions, a number telling you how many data pairs it contains, and the data pairs. Here's a short sample (don't type this into your computer):

```
Title:       *** WEIGHTS AND MEASURES ***
Question 1:  WHAT IS THE ENGLISH EQUIVALENT OF...
Question 2:  WHAT IS THE METRIC EQUIVALENT OF...
Count:       6
Data Pairs:  1 METER, 1.1 YARDS
             1 LITER, 1.06 U.S. QUARTS
             1 KILOGRAM, 2.2 POUNDS
             0.9 METER, 1 YARD
             0.95 LITER, 1 U.S. QUART
             454 GRAMS, 1 POUND
```

The title identifies the subject of the quiz. Questions 1 and 2 are used with the first and second items in each data pair, respectively. For example, questions might be, "What is the English equivalent of 1 meter?" or "What is the metric equivalent of 1.1 yards?" You must set up the data pairs consistently so that the questions will always be applicable. In our example, the first item in each data pair must be a metric quantity and the second item, an English equivalent.

The Program

The program is written in Microsoft BASIC and should run on most computers. We'll point out the

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lines that may need a little modification to run on Applesoft BASIC and other nonstandard BASICs. If you still can't get the program to run after typing it in and eliminating typographical errors, go back through and try the alternate lines we suggest.

Start by typing in these lines:

```
10 PRINT "THE QUIZ MASTER"
20 PRINT
30 READ T$
40 PRINT T$
50 PRINT
60 DIM Q$(2)
70 READ Q$(1), Q$(2)
80 READ N
90 DIM L$(N,2),T(N),S(N)
100 FOR J=1 TO N
110 READ L$(J,1), L$(J,2)
120 NEXT J
```

These lines put the data pairs in the database and display a title on the screen. T$ contains the database title. The array Q$( ) contains the two questions. Array L$(,) holds the database. For example, array element L$(1,2) contains the second item of the first data pair. Arrays T( ) and S( ) are used to shuffle the questions so the computer won't ask them in the same order each time.

The following lines present the main menu. Type them in:

```
130 TC=0
140 TH=0
150 FOR J=1 TO 2
160 PRINT J; TAB(10) Q$(J)
170 NEXT J
180 INPUT "SELECT 1 OR 2"; C
190 ON C GOTO 210,240
200 PRINT: GOTO 150
210 Q=1
220 A=2
230 GOTO 260
240 Q=2
250 A=1
```

Variable TC keeps track of your total number of correct answers. TH counts the number of hints you have used. Lines 150 to 170 print the menu on the screen. Lines 180 to 200 get the question you selected and branch to the appropriate section of the program.

The variables Q and A keep track of which question you selected so that a single routine can handle both options. Q equals 1 and A equals 2 when you choose question 1; Q equals 2 and A equals 1 when you choose question 2.

Now it's time to shuffle the questions. Type in these lines:

```
260 PRINT
270 PRINT "SHUFFLING THE QUESTIONS. STAND BY..."
280 PRINT
290 FOR J=1 TO N
300 T(J)=0
310 NEXT J
320 FOR J=1 TO N
330 R=RND(N)
340 IF T(R)=1 THEN 330
350 S(J)=R
360 T(R)=1
370 NEXT J
```

These lines set up a random sequence for asking the questions. Array S( ) contains that sequence. For example, S(1) contains the sequence number of the first pair, S(2) contains the sequence number of the second pair, and so forth. Array T( ) keeps track of which pairs have been placed in the random sequence.

Lines 290 to 310 set every element of T( ) to 0, which indicates that no questions have been placed in the sequence yet. Lines 320 to 370 pick out pairs 1 through N and assign a sequence number R to each. Line 340 checks to see whether a given sequence number has already been used. If it has, the program goes back to line 330 for another sequence number.

For example, suppose you have six data pairs. After completion of line 370, the array S( ) might look like this (don't type this in):

```
S(1)=5
S(2)=1
S(3)=3
S(4)=2
S(5)=6
S(6)=4
```

This array indicates that data pair 1 would be fifth in the question-answer sequence; data pair 2, first; and so forth.

If you have Applesoft or certain other versions of BASIC, you will need to modify line 330. In Microsoft BASIC, the RND(N) function produces a random integer from 1 to N, where N is a number greater than 1. Not all BASICs have this handy capability. Instead, they return a random value between 0 and 1, which your program must "expand" into the desired range. If this is the case with your version of BASIC, change line 330 to

```
330 R=INT(RND(1)*N)+1
```

or

```
330 R=INT(RND(0)*N)+1
```

depending on how your RND function works. Experiment until you get R to take on random values from 1 to N.

Now comes the question-answer routine. Type in these lines:

```
380 FOR J=1 TO N
390 W1$=L$(S(J),Q)
```

```
400 W2$=L$(S(J),A)
410 LA=LEN(W2$)
420 M$=STRING$(LA,"*")
430 PRINT
440 PRINT Q$(Q) W1$
450 INPUT R$
460 IF R$=W2$ THEN 510
470 IF M$=W2$ THEN 540
480 INPUT "INCORRECT. WOULD YOU LIKE A HINT (Y/N)"; R$
490 IF R$="Y" THEN GOSUB 610
500 GOTO 430
510 PRINT "CORRECT!"
520 TC=TC+1
530 GOTO 550
540 PRINT "THE CORRECT ANSWER IS "; W2$
550 NEXT J
```

Line 380 opens the loop (a block of instructions that the program repeats a certain number of times), and line 550 closes the loop. The program will quiz you on each data pair in the random sequence determined by array S( ).

W1$ contains the word to be included in the question, and W2$ contains the correct answer. Lines 410 and 420 set up a mask to be used in giving hints. We'll present and explain the hint routine later on. If your computer doesn't have the STRING$ function, replace line 420 and add these lines:

```
420 M$=" "
422 FOR J1=1 TO LA
424 M$=M$ + "*"
426 NEXT J1
```

Line 440 prints the question, plugging in the appropriate word from the database. Line 460 compares your answer with the correct answer. Near misses don't count—the answer must match exactly. If you are correct, lines 510 to 530 congratulate you, update your score, and move on to the next question. If you are incorrect, lines 470 to 500 determine whether to give you a hint. If you've received all possible hints, the program tells you the answer and continues with the next question. Otherwise, you can either look at the next hint or try to guess the answer without a hint.

After asking all the questions, the program gives you your score and asks whether you want more practice. Type in these lines now (we're almost through):

```
560 PRINT "YOU GOT " TC "CORRECT OUT OF " N
570 PRINT "USING" TH "HINTS."
580 INPUT "TYPE 1 TO QUIT, 2 FOR MORE PRACTICE"; C
```


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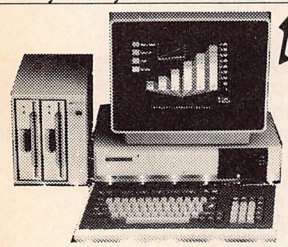

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It's not too late.

```
590 IF C=1 THEN END
600 GOTO 130
```

Here's the hint routine. Type it in:

```
610 TH=TH+1
620 PRINT "EACH * STANDS FOR A MYSTERY LETTER"
630 PRINT "HERE IS YOUR HINT: " M$
640 R=RND(LA)
650 IF MID$(M$,R,1)<>"*" THEN 640
660 MID$(M$,R,1)=MID$(W2$,R,1)
670 RETURN
```

Whenever you request a hint, the program increments the total number of hints used (line 610), gives you the hint M$ (lines 620 and 630), and modifies M$ to produce the next hint (lines 640 to 660).

Initially, the hint consists of a string of asterisks, one for each character in the answer. After the program gives you each hint, it replaces a randomly selected asterisk with the character that belongs in that position. Line 640 gets a character position R from 1 to LA (the length of the answer). Line 650 determines whether that character has been revealed yet. If it has, the program tries another character position. If it hasn't, the program uncovers that character (line 660).

Line 640 is similar to line 330 in that both use the RND(N) function. If you changed line 330, you will also need to change this line. For Applesoft BASIC and some other versions, use:

```
640 R=INT(RND(1)*LA)+1
```

or

```
640 R=INT(RND(0)*LA)+1
```

The Database

The only thing missing from our program now is the database. This is where you customize the program. Store the database in DATA statements starting with line 680. Here is a short sample database. Type it in so you can test the program:

```
680 DATA *** FRENCH/ENGLISH FOODS ***
690 DATA WHAT IS THE FRENCH WORD FOR...
700 DATA WHAT IS THE ENGLISH WORD FOR...
710 DATA 24
720 DATA ACORN, LE GLAND DU CHENE, APPLE, LA POMME
730 DATA ASPARAGUS, LES ASPERGES, BEEF, LE BOEUF
740 DATA BREAD, LE PAIN, BUTTER, LE BEURRE
750 DATA CAULIFLOWER, LE CHOU-FLEUR, CHEESE, LE
    FROMAGE
```


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B. TOUCH DESIRED KEY ON VIP to be programmed.
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E. REPEAT A-D for all 31 keys
F. TOUCH SHIFT LOCK KEY ON VIP
G. TOUCH PROGRAM KEY ON VIP and repeat steps B-E.
[P.] LED exhibits "P" and decimal point indicating that you are programming a key in shifted mode.
H. TOUCH PROGRAM SELECT KEY
LED changes to reflect which 1 of 4 keyboards you're programming. [1] [2] [3] [4]
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```
760 DATA DATE, LA DATTE, DOUGHNUT, LE PET DE NONNE
770 DATA EGG, L'OUEF, EGGPLANT, L'AUBERGINE
780 DATA FISH, LE POISSON, GINGERBREAD, LE PAIN D'EPICE
790 DATA GRAPEFRUIT, LA PAMPLEMOUSSE, GRAPE, LE GRAIN
    DE RAISIN
800 DATA HONEY, LE MIEL, LEMON, LE CITRON
810 DATA MUTTON, LE MOUTON, PEACH, LA PECHE
820 DATA SUGAR, LE SUCRE, SYRUP, LE SIROP
830 DATA TURKEY, LE DINDON, YAM, L'IGNAME
```

Another useful database—states and capitals—is shown below. Use your imagination to think up other possibilities. Just be sure to set up the database like the one in our example. □

The Capital of South Dakota Is . . .

Use this database to test your knowledge of states and capitals.

```
680 DATA *** STATES AND CAPITALS ***
690 DATA WHAT IS THE CAPITAL OF . . .
700 DATA WHAT STATE HAS THE CAPITAL CITY OF . . .
710 DATA 50
720 DATA ALABAMA, MONTGOMERY, ALASKA, JUNEAU
730 DATA ARIZONA, PHOENIX, ARKANSAS, LITTLE ROCK
740 DATA CALIFORNIA, SACRAMENTO, COLORADO, DENVER
750 DATA CONNECTICUT, HARTFORD, DELAWARE, DOVER
760 DATA FLORIDA, TALLAHASSEE, GEORGIA, ATLANTA
770 DATA HAWAII, HONOLULU, IDAHO, BOISE
780 DATA ILLINOIS, SPRINGFIELD, INDIANA, INDIANAPOLIS
790 DATA IOWA, DES MOINES, KANSAS, TOPEKA
800 DATA KENTUCKY, FRANKFORT, LOUISIANA, BATON ROUGE
810 DATA MAINE, AUGUSTA, MARYLAND, ANNAPOLIS
820 DATA MASSACHUSETTS, BOSTON, MICHIGAN, LANSING
830 DATA MINNESOTA, ST. PAUL, MISSISSIPPI, JACKSON
840 DATA MISSOURI, JEFFERSON CITY, MONTANA, HELENA
850 DATA NEBRASKA, LINCOLN, NEVADA, CARSON CITY
860 DATA NEW HAMPSHIRE, CONCORD, NEW JERSEY, TRENTON
870 DATA NEW MEXICO, SANTA FE, NEW YORK, ALBANY
880 DATA NORTH CAROLINA, RALEIGH, NORTH DAKOTA,
    BISMARCK
890 DATA OHIO, COLUMBUS, OKLAHOMA, OKLAHOMA CITY
900 DATA OREGON, SALEM, PENNSYLVANIA, HARRISBURG
910 DATA RHODE ISLAND, PROVIDENCE, SOUTH CAROLINA,
    COLUMBIA
920 DATA SOUTH DAKOTA, PIERRE, TENNESSEE, NASHVILLE
930 DATA TEXAS, AUSTIN, UTAH, SALT LAKE CITY
940 DATA VERMONT, MONTPELIER, VIRGINIA, RICHMOND
950 DATA WASHINGTON, OLYMPIA, WEST VIRGINIA, CHARLESTON
960 DATA WISCONSIN, MADISON, WYOMING, CHEYENNE
```

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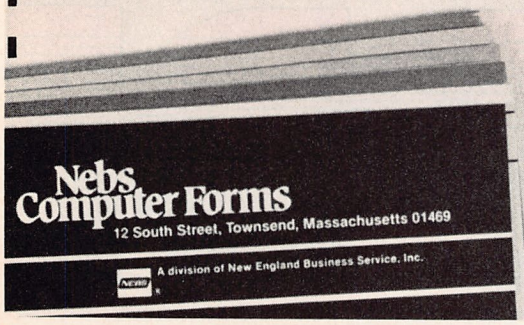

COMING UP

Special Report on Computer Languages

If you behold the view from computerdom's Tower of Babel, you realize that there are dozens of major microcomputer languages and scores of lesser-known ones. The core of next month's issue is our special report on these languages, offering information that cuts across the user spectrum. Beginners and advanced programmers alike will learn a lot from "Family Tree of Languages," a history of how each language begat another. We'll examine the strengths and weaknesses of the major languages (including BASIC, FORTRAN, COBOL, Pascal, and C), then we'll turn our attention to the up-and-coming languages such as LISP, FORTH, and PROLOG.

All About Dialects

Hand in hand with the special report on computer languages is next month's Program Factory, which provides tips on how to modify BASIC programs to conform to the dialect that runs on your machine. Most computer instructors will tell their students that, yes, every microcomputer has its own unique dialect, but they seldom push on to the next logical question: *how* do you get from one dialect to another? September's Program Factory provides practical guidelines on making translations so you can modify most BASIC programs to run on your system. We think that this inter-dialectic lesson offers more fun than most intergalactic computer games—and it can make you a much more competent programmer.

Radio Shack's Newest Pocket Computer

The folks at Radio Shack weren't content to rest on their laurels after releasing the PC-1 and PC-2. Now we have the pleasure of reviewing the newly introduced PC-4 (there is no PC-3 for some reason), a nifty unit offering plenty of attractive features for its eye-opening $70 price.

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In this new computer game for the Apple II and TRS-80 Models I and III, Monty isn't a Hall or a Python—he's an on-screen character who plays Scrabble with you alone or as a fourth. Because Monty costs only $39.95 (for the Apple) or $34.95 (TRS-80) and doesn't spend 20 minutes deliberating each move, he may become your favorite opponent.

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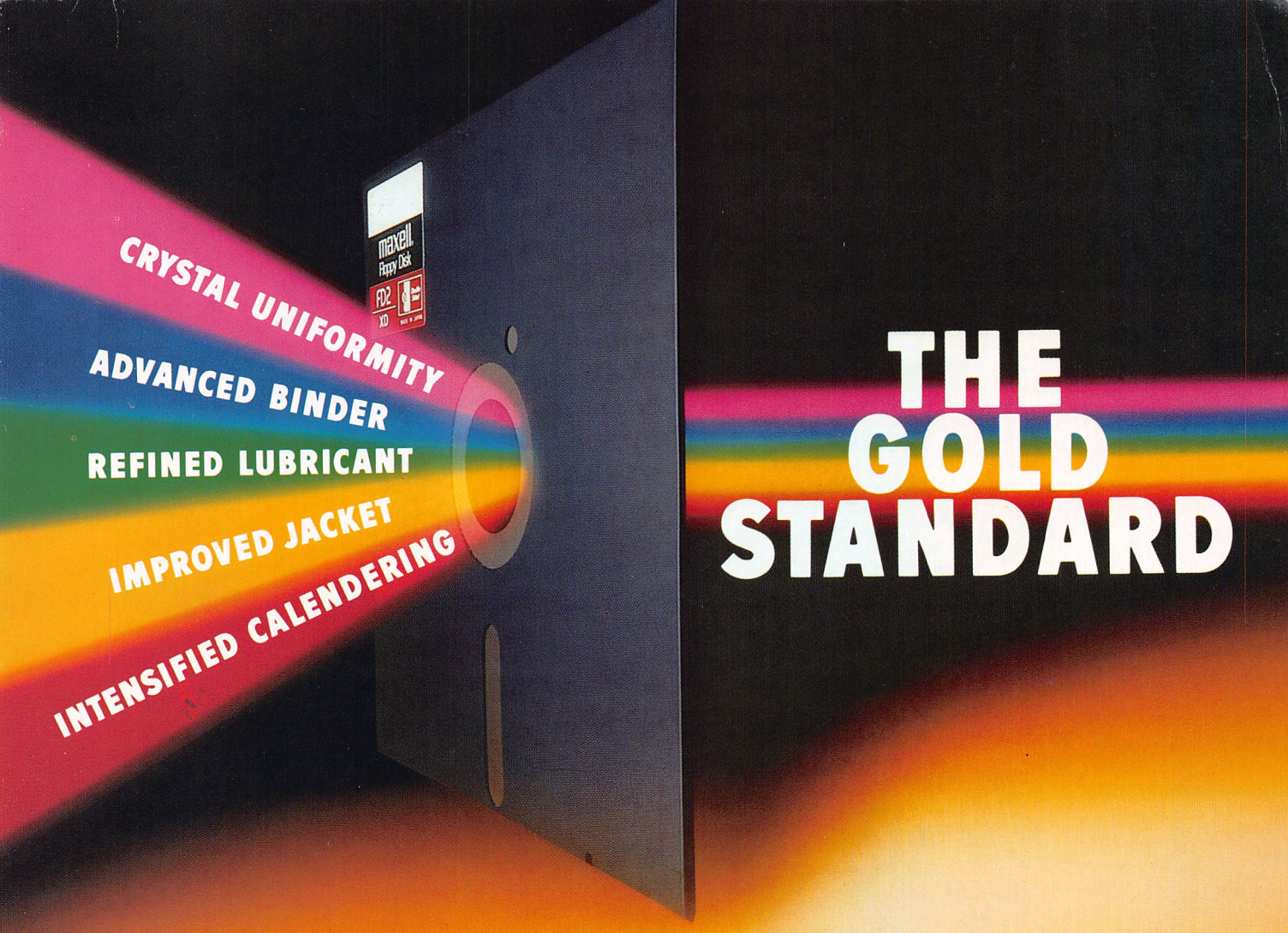

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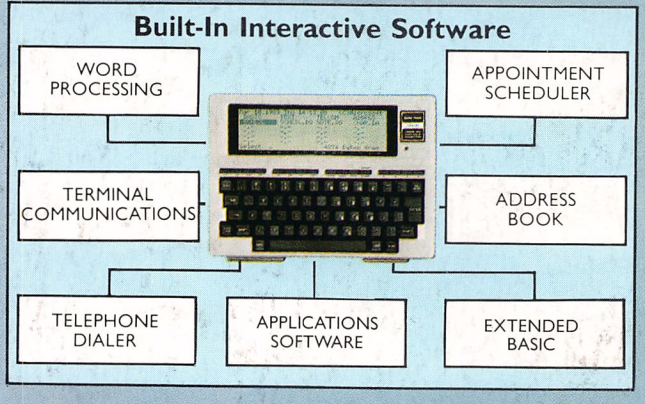

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